Editorial

In previous years we have published a wide range of papers in *Phelsuma*, varying from taxonomy to animal behaviour, conservation and population genetics. This year sees two major themes, one is a special focus on plants and the other is taxonomic description. The botanical papers demonstrate the activity and high quality of botanical research in the region. Madagascar is an obvious centre for such research due to its extraordinary plant diversity and we are pleased to publish an in-depth analysis from the island of the floristics of a particularly remarkable forest. The flora of the Mascarene islands is much less diverse and has been relatively well studied. However, notable discoveries are still being made and we report on two such discoveries made in recent years. There are botanical research projects on other islands but publications remain rare; it is to be hoped that communication within the region's botanical community will improve in the near future.

This year we include three taxonomic papers. To a large extent these are based on material collected by, or revisions inspired by the Indian Ocean Biodiversity Assessment 2000-2005. These highlight the important developments in taxonomy taking place in the region. Species description is an essential first step in understanding our environment and setting conservation priorities. Our knowledge of the Seychelles fauna is developing rapidly and there is increasing interest in applying molecular techniques to some taxonomic issues and the questions of population genetics. These are major research avenues that need to be used if we are to develop truly scientifically based conservation in the region. Madagascar is making great strides in this regard but access to genetic resouces remains a contentious issue elsewhere. If the access issues can be resolved the prospects of scientific conservation in the islands should be bright.

J. Gerlach
Editor

Chairman's Report

This year saw the final surveys and collecting stages of the Indian Ocean Biodiversity Assessment 2000-2005. An international symposium will be held at the Zoological Society of London to present the conclusions drawn from the assessment. The surveys carried out over the last five years will complement and celebrate collections made 100 years ago during the Percy Sladen Trust Expeditions. The symposium will highlight the conservation needs of the region's biodiversity in the light of the changes occasioned by colonisations and extinctions over the past 100 years.

Our support for the Indian Ocean Biodiversity Assessment highlights one of the major problems experienced by all small grass-roots NGOs – the difficulty of funding projects, especially those that involve elements of taxonomy or research. Despite a vast amount of time spent writing project proposals for various likely funding sources, we ended up financing this project in its entirety from our own meagre resources. We are extremely grateful for the unstinting support and passion given to the project by a global network of specialist taxonomists who have identified and described specimens in their own time.

From the Chairman and members of NPTS, our biggest debt of thanks should go to our Scientific Co-ordinator, Dr. Justin Gerlach, who has worked tirelessly on this project, sifting through tens of thousands of specimens and preparing them for the taxonomists, report writing and organising the forthcoming symposium – and all this on a purely voluntary basis.

As a result of the work already completed on the IOBA, the first volume of a series of monographs has been published. "Lepidoptera of the Seychelles Islands" by Justin Gerlach and Pat Matyot, describes all the known species and historical records of our Lepidoptera. We are grateful to Conservation International (Madagascar) for funding the colour plates of this publication.

NPTS has long encouraged conservation initiatives in the outer islands, most of which are managed by the Islands Development Company, this has now been formalised with a Memorandum of Understanding between NPTS, IDC and the Islands Conservation Society. Under this MoU NPTS and ICS collaborate on developing and supporting conservation projects on IDC managed islands.

We are grateful to the following individual donors and organisations for their support:

Peter Kistler of SAN	Donation for publications
Rick Watson	Donation for projects
Conservation International	Funding for publication and projects
Silhouette Island Resort	Equipment funding
Islands Development Company	Logistical and other support
Pool & Patel	Honorary auditors

Volunteers
In May, Dr. Christina Oliver spent a month on Silhouette in order to help us discover the pollinator of *Impatiens gordonii.* Unfortunately very persistent and heavy rain washed the project out. Miles Taylor spent a month at Grande Barbe in June, helping to track down some of the old sheath-tailed bat roosts. Veterinary graduates Bertrand Fiol and Hélène Chardon were on Silhouette, Curieuse and North island. They were investigating the diet of free-ranging tortoises in preparation for the release on Silhouette of tortoises from our project. Global Vision International have been carrying out turtle nesting monitoring at Grande Barbe on our behalf. Ann and Bill Truscott looked after our projects when we were away in December. The annual biology field trip of the International School in June included a day of voluntary work in our forest rehabilitation project. As ever, we are grateful to these volunteers for their dedication and support.

Scientific Visitors
In January, representatives from Earthwatch – a U.K. based volunteer organisation – visited Silhouette in preparation for their forthcoming project to assess the coral reefs and habitats around Silhouette. Unfortunately, with the hotel development taking longer than anticipated, there would be no accommodation available and the project has had to be rescheduled for next year.

In May, representatives from relevant government ministries, led by Mr. Didier Dogley, visited Silhouette to survey a proposed Grande Barbe to La Passe road route.

Other Visitors
In October, a film crew from Films Concept Associés spent a day on Silhouette, filming our projects for Ushaia Television's film entitled "Guardians of Nature".

In December a group of members of the British Chelonia Group visited the projects en route to Aldabra.

Overseas Visits and Meetings
In November, Dr. Justin Gerlach attended a meeting at the University of Stellenbosch, South Africa organised by the IUCN's Species Survival Commission Invertebrate Sub-Committee.

Seychelles Giant Tortoise Conservation Project
For the third consecutive year, we have had excellent breeding success, bringing the total number of hatchlings to 137. Josephine, *Dipsochelys hololissa,* has shown improved fertility and produced 12 hatchlings. The other *D. hololissa* female, Eve, was examined by veterinary graduates, Hélène Chardon and Bertrand Fiol, who could find no problem with her. She has been unable to lay eggs despite digging perfect nest holes.

The increased number of hatchlings and now juvenile tortoises obliged us to build a second large outdoor enclosure for the largest of the juveniles which weigh between 1.5

and 8 kg. It looks very much as though we will need another enclosure in the near future and prior to the planned release later this year.

Seychelles Terrapin Conservation Project

The general disruption last season caused by the long drawn-out construction of a new series of ponds for the terrapins, put the damper on breeding activity. These ponds are now operational and the “landscaping” back to normal well in time for this year’s breeding season. We had only two clutches last season, one from each species. An unfortunate malfunction of the incubator meant that no *Pelusios castanoides* eggs hatched. The *Pelusios subniger* clutch was laid in a poorly excavated nest very late in the season and the eggs were infertile.

Silhouette Conservation Project

A major redevelopment of the hotel at La Passe was begun in January 2005. The old Silhouette Island Lodge of 12 rooms is being replaced by a new hotel, to be called “LaBriz”, which has 112 rooms and all the infrastructure necessary to support an hotel of this size. With some 700 plus foreign construction workers on the island and all the operational support necessary for such a development, we have seen the almost total demise of day visitors to Silhouette – our major source of income through sales of fund-raising items.

The forest rehabilitation project has continued to develop slowly – forest rehabilitation is a very long-term commitment. Many of the plants which we grew in the nursery and which were planted out several years ago are now quite large saplings and the general appearance of the top section has changed from coconut/cinnamon jungle to a more open native woodland.

Seychelles Sheath-Tailed Bat Project

This year we have been able, with volunteer help, to investigate possible roost sites at Grande Barbe. Although only single bats have been detected there, and no permanent roost has been located, fresh bat guano has been found in the roost that Grande Barbe residents claim was once occupied. These sites require vegetation management as they have generally become overgrown or the roost entrances blocked by coconut scrub.

The roost at La Passe is now equipped with a permanent monitoring camera. This roost remains the single most important roost in Seychelles and is home to around 32 of these highly endangered bats. Investigation into the food of the bats, which is carried out by collecting bat guano and sifting through it for identifiable insect parts, is part of the project, as is the dispersal of bats from the roost. The bat camera will answer many questions relating to breeding and behaviour.

Ron Gerlach
Chairman

2005 Publications

[Ami = Amirantes; Ald = Aldabra; Sey = Seychelles]

Agnarsson, I. & Kuntner, M. 2005 Madagascar: an unexpected hotspot of social *Anelosimus* spider diversity (Araneae: Theridiidae). *Systematic Entomology* **30**(4); 575-592 [Ald]

Burger, A.E. 2005 Dispersal and germination of seeds of *Pisonia grandis*, an Indo-Pacific tropical tree associated with insular seabird colonies. *Journal of Tropical Ecology* **21**(3); 263-271 [Sey]

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Jones, C.D. 2005 The genetics of adaptation in *Drosophila sechellia*. *Genetica* (Dordrecht) **123**(1-2); 137-145 Sey]

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importance of radiocarbon dating for ancient DNA studies. *Amphibia-Reptilia* **26**(1); 116-121 [Sey]

Komdeur, J. 2005 No evidence for adaptive suppression of joint laying by dominant female Seychelles warblers: an experimental study. *Behaviour* **142**(11-2); 1669-1684 [Sey]

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Phelsuma **14**; 7-12

On the discovery of a new endemic *Cynanchum* (Apocynaceae) on Gunner's Quoin, Mauritius

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Abstract -*Cynanchum scopulosum* Bosser (Apocynaceae), a new Mauritius endemic species was discovered in 2003 on Gunner's Quoin Nature Reserve, a highly degraded offshore islet north of Mauritius. The plant's basic ecology is described and threats to its persistence are discussed. The species is Critically Endangered. Recommendations to secure its future are given. The discovery adds further conservation value to Gunner's Quoin.

Key words - *Cynanchum scopulosum*, islet restoration, invasive species, IUCN conservation status.

Introduction

The flora of Mauritius started to be documented during the late 18th century, and within two centuries most of its species had been described (Bosser *et al*. 1976-onwards). However, despite having only about 5% of its original native vegetation left, new records of native plant species continue to be made. Recent examples include a new endemic Myrtaceae, *Syzygium guehoi* Bosser & Florens (Bosser & Florens 2000), discovered in 1989, or the orchid *Taeniophyllum coxii* (Summerh.) Summerh., an aphylous epiphyte of wide distribution first recorded in Mauritius in 2000 (Roberts *et al*. 2004). Here we report on the latest such discovery, made in 2003, of a *Cynanchum* species (Apocynaceae) endemic to Gunner's Quoin islet, north of Mauritius.

The Apocynaceae is a large mainly tropical family of some 415 genera and 4,555 species (Stevens 2001-onwards) of which some 200 belong to the genus *Cynanchum*[1] (Mabberley 1997). In Mauritius, the Asclepiadoideae is represented by six native genera and 11 native species (Bosser & Marais 2005).

The first mention of *Cynanchum* in Mauritius, of which the species cannot be ascertained, was made by Bojer (1837) under *Sarcostemma mauritianum*. It was recorded on high mountains on Mauritius, a habitat type today occupied by *C. glomeratum*. Later, Baker (1877) mentioned a second species, *Decanema bojerianum* Decne (=*C. luteifluens* (Jum. & H. Perrier) Desc.)), which appears to be the same as Bojer's taxon (Bosser & Marais 2005). Later references to *Cynanchum* in Mauritius are under *Sarcostemma viminale* (ex. Vaughan 1937, Guého 1988). It is now established however that Rodrigues has one and Mauritius three endemic species of *Cynanchum* (Bosser & Marais 2005). No native *Cynanchum* is known from Reunion island.

[1] In the Flore de Mascareignes *Cynanchum* is treated under Asclepiadaceae

Methods

Study site

Gunner's Quoin, a 76ha offshore volcanic islet 4 km north of Mauritius, consists of rock laid down 0.7-0.025M years ago (Montaggioni & Nattivel 1988) and culminates at 162m a.m.s.l. Most of the islet consists of friable volcanic tuft while the eastern side has an overlying basalt layer. Inferring from Camoin *et al.* (2004), the islet would have been cut off from mainland Mauritius by rising sea level some 10,000 years ago. Vaughan and Wiehe (1937) believed that the islet supported a palm savannah in its pristine condition before being much altered by human activity since the 18th century. The most recent published botanical surveys previous to our visit revealed an ecosystem largely overrun by alien plants which made up 48 of the 72 higher plant species (Dulloo 1994). Despite its advanced degradation state, where large parts of the islet are dominated by invasive plants, Gunner's Quoin still harbours some valuable native relicts like the largest population of the Mauritius endemic *Lomatophyllum tormentorii*. The native vertebrate fauna includes mainly tropic birds (*Phaeton rubricauda* and *P. lepturus*) and Wedge-tailed shearwater (*Puffinus pacificus*) as well as four species of reptiles. The eradication of Norway rats (*Rattus norvegicus*), black-naped hare (*Lepus nigricollis*) and domestic rabbit (*Oryctolagus* sp.) in the 1990's (Bell 2002), greatly enhanced the conservation value of the islet particularly as a site for eventual reintroduction of reptiles from Round Island.

Surveys

The authors found the new *Cynanchum* species during a four-days biodiversity survey of the islet in December 2003 under a Government of Mauritius project commissioned for the creation of the Islets National Park. The survey was carried out in all different areas safe the inaccessible western cliffs which were examined where possible with binoculars. Ecological notes, like level of threats posed to the habitat by alien species, were taken to allow for an assessment of the threat category of the species using IUCN Criteria (IUCN 2001). Samples were deposited at the Mauritius Herbarium and duplicates sent to the Herbarium of the Museum National d'Histoire Naturelle, Paris.

Results

We found 77 higher plant species including the new *Cynanchum* of which a colony of an estimated two dozens intermingled individuals was found. A sample was deposited at the Mauritius Herbarium (Holotype MAU 23772). Other vouchers collected on a second visit in 2004 are: MAU 24070, 24071, 24072, 24073 and 24074.

C. scopulosum was growing from the upper scarp downwards on a near vertical sea facing cliff and its ledges in the south west of the islet between 20-50 m amsl (Fig. 1). The species is a rather procumbent liana with branches reaching one cm in diameter. It has markedly constricted nodes and a silvery green tinge that distinguishes it vegetatively from all other Mauritian *Cynanchum*. Its branching stems reach several metres long and creeps over exposed rocks and low cliff vegetation. Towards their extremities, the stems are usually erect sometimes reaching one meter high. The colony spans a maximum

of about 40 m laterally and 30 m vertically and varies from dense monospecific areas towards its core to more diffused growth towards the edges where it grows together with several other native species including *Tylophora coriacea* (Apocynaceae), *Lomatophyllum tormentorii* (Asphodelaceae), *Scaevola taccada* (Goodeniaceae), and more rarely with *Latania loddigesi* (Arecaceae) and *Dicliptera falcata* (Acanthaceae). There is, however, a number of invasive alien plants that appear to be encroaching on the *Cynanchum*'s habitat, including the fire prone grass *Heteropogon contortus* and other aggressive weeds like *Flacourtia indica* (Salicaceae) and *Opuntia vulgaris* (Cactaceae) that have already developed into dense stands or thickets elsewhere on the islet.

Discussion

The flora of Gunner's Quoin was thoroughly surveyed at least three times (Bullock *et al.* 1983, Dulloo 1994, MWF 2003) since its description in the 1930's (Vaughan & Wiehe 1937). It thus appears surprising that the new *Cynanchum* species covering a patch of several dozen metres across was discovered only in December 2003. However, while some surveys genuinely missed the plant (Vaughan & Wiehe 1937, MWF 2003), others appeared to have located but misidentified it. Thus Bullock *et al.* (1983) recorded an alien tree weed, *Euphorbia tirucalli* (Euphorbiaceae) where we discovered *C. scopulosum*. Another survey by Bell *et al.* (1994) mentioned a clump of *E. tirucalli* where we later found the *Cynanchum* colony. In fact, *C. scopulosum* superficially resembles *E. tirucalli* from a distance. Infertile herbarium samples of the two species can also be very similar. We found no *E. tirucalli* on the islet.

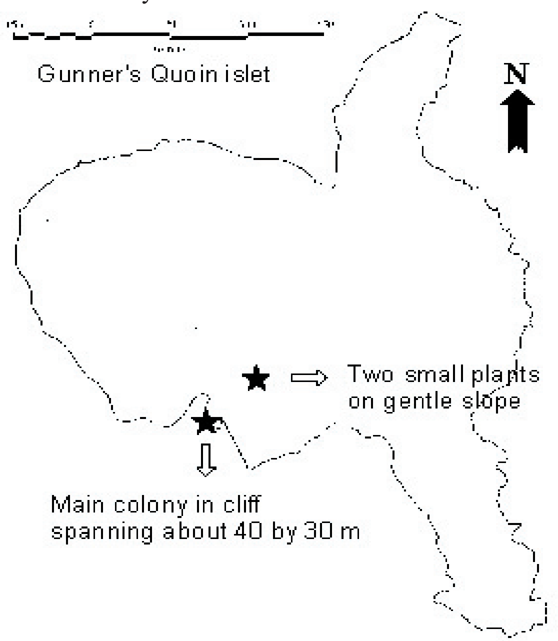

Fig 1. Distribution of *Cynanchum scopulosum* on Gunner's Quoin Islet Nature Reserve, north of Mauritius.

It is fortunate that there was no attempt to eradicate the misidentified *Cynanchum* during restoration of the islet like was successfully done with rats, hares and rabbits (Bell 2002). But it is worrying that a plant found on nearby Serpent Island in 2003 and identified as a weed by the expedition members, which comprised no experienced botanist, has been destroyed and that no sample was kept (Tatayah & Cole 2004). There exists also the unfortunate habit on Mauritius to weed *Cynanchum* spp. from areas managed for conservation because it is a toxic plant. Weeding of *Cynanchum* has been reported from Ile aux Aigrettes Nature Reserve (A. Khedun pers. comm. 2004), Perrier Nature Reserve and Mondrain Private Reserve (G. D' Argent, pers. comm. 2004). *Cynanchum* seems now eradicated from the latter two sites.

Conservation status

C. scopulosum is known only from Gunner's Quoin. A second expedition there in August 2004, revealed a tiny second clump of two plants on a ridge 100m from the first colony bringing the total area occupied by the species to less than 0.1ha in two separate places (Fig. 1). The species thus has one of the most restricted range for an endemic plant on Mauritius.

This fact alone exposes it to a high threat of extinction in the wild. The colony may thus easily be destroyed by fire, the more so that much of the islet is today invaded by fire prone *Heteropogon contortus*, and also receive illegal visitors regularly lighting camp fires. Indeed, devastation by fire has been recorded in the past (Dulloo 1994) and probably explains partly at least both why the islet is so poor in native plants and why the *Cynanchum* itself has such a restricted and marginal distribution.

Fig. 2. *Cynanchum scopulosum* on Gunner's Quion - young plant and flowers.

Destruction of the colony by a landslide appears likely as this is a common feature on the island as indicated by numerous rock fall scars on the sea facing cliffs. The site where *Cynanchum* grows is also gradually being invaded by alien plants. Thus, the species should be regarded as Critically Endangered (CR B1ab(iii) + 2ab(iii); D).

Given these risks, we recommend that the plant be propagated to several locations of suitable ecology on the islet itself, including well inland. Also the proximity and similar climate and geology of Round and Flat Islands, and their ongoing restoration programmes make them ideal sites to receive translocated *C. scopulosum*. Establishing these populations would greatly reduce the plant's extinction risks in the wild. It is quite conceivable that *C. scopulosum* might have once grown on these two islets given the plant's efficiently wind-dispersed seeds and the fact that many native species are known not to have survived the human-induced ecological devastation of both islets.

Extinction risks will also be minimised by maintaining the plant in *ex-situ* facilities. *C. scopulosum* is easy to propagate. All 12 cuttings taken rooted without rooting hormones within 5-6 weeks. These are being grown in the arboreta of the National Parks and Conservation Service and of the Mauritius Herbarium (MSIRI). Propagation by seeds, although advisable, seems less easy for the moment due to the currently rather rare expeditions to the islet and since the plants appear to set very few fruits at a time.

Acknowledgements

We are grateful to Mr Yousouf Mungroo and Mr Kevin Ruhomaun of the National Parks and Conservation Service, for having organised the trip to the islet. C.B. thanks J-C. Autrey for reviewing the draft.

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Phelsuma **14**; 13-36

Etude de la variation de la structure et de la composition floristique de la forêt des Mikea du sud-ouest de Madagascar

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Résumé - La forêt de Mikea a fait l'objet d'un intensif inventaire floristique quantitatif et qualitatif, pendant le mois de mars 2002 et 2003. Cinq transects ont été tracées pour étudier la variation est - ouest et nord - sud de la Forêt. Treize sites ont été ainsi étudiés. Deux cent vingt et un parcelle-transects de 100m² (50 m x 2 m) non permanentes ont été mis en place. Un total de 12838 pieds de plantes ont été recensées. Chaque espèce rencontrée a été nommée par son nom vernaculaire et son nom scientifique et récoltée. Ces derniers seront ensuite vérifiés dans les herbiers.

Au total 69 familles, 166 genres reparties en 283 morpho-espèces ont été recensées lors de cette étude. Les résultats des analyses du sol ont montré des variations notables. Sur les 13 sites, la richesse floristique, la densité et la composition floristique ainsi que la structure changent avec la longitude et la latitude en même temps que la nature du sol. Cependant ces variations ne suivent pas un model fixe mais plutôt en mosaïque (dispersé). Ces diversité spécifique, structurales montrent la richesse et diversité d'habitat de la région. Ces variations montrent l'importance de la conservation des tout le restes des formations existantes dans la région pour assurer la représentativité et la viabilité des espèces. Le type de gestion ou de conservation dépendra par la suite des gestionnaires et de la capacité de charge des habitat.

Abstract - The forest of Mikea was the subject of an intensive quantitative and qualitative floristic inventory. Five transects were traced to study the east-west and north-south variation of the forest. 13 sites were studied. 221 non-permanent transects of 100m² (50x2m) were set up. A total of 12838 plant stems were recorded. Each species located was recorded by its vernacular and scientific names. The latter were verified by comparison in herbaria.

Of the 69 families, 166 genera with 283 morpho-species were found. The results of soil analyses showed notable variations in the 13 sites, in floristic richness, density and floristic composition as well as structural changes with longitude and latitude and soil characteristics. However, these variations do not follow a fixed model but rather a mosaic (dispersed) pattern, demonstrating the richness and diversity of the habitat of the area.

These variations show the importance of conserving all of the remainder of the existing formations in the area to ensure the representativeness and viability of the species. The type of management or conservation will depend thereafter on the managers and the load capacity of the habitat.

Key words - Mikea forest, ecological variation, longitudinal variation

Introduction

Le sites d'études se trouve dans les pays Mikea qui est localisé dans la partie sud-ouest de Madagascar entre la Rivière Manombo, au sud et le fleuve Mangoky, au nord. Mikea désigne en même temps le nom d'un «clan» vivant dans la forêt et mode vie de ces clan (Seddon 2000). Il est délimité à l'est par la RN9 reliant Toliara à Manja et à l'ouest par la zone côtière (fig.1). La forêt de Mikea, située au nord de la ville de Toliara, est définie par le programme «Madagascar Dry Forest» (MDF) ou Ala Maiky du WWF comme le complexe se trouvant entre la rivière Fiherenena au sud et le fleuve Mangoky au nord. Elle se développe sur des substrats sableux qui passe progressivement

du roux (à l'est) au blanche (à l'ouest) selon l'âge géologique de la formation. A cette variation pédologique s'accompagne une variation climatique (Humbert 1965). En effet les courbes de l'isohyète (moyenne annuelle) montre un variation est - ouest et nord - sud (Humber 1955). A ces conditions assez particulières correspondent des types de formations végétales dont la typologie suit progressivement cette variation abiotique. On peut y rencontrer de la forêt dense sèche à l'intérieur des terres au fourré xérophile sur les côtes en passant par les « hauts » fourrés (Razanaka 1995). La transition entre les différentes formations est progressive bien qu'elle soit plus nette pour le passage des hauts fourrés sur sol sableux vers la formation dunaire et rocailleuse dominée par l'*Euphorbia stenoclada*.

De part sa particularité et son importance biologique et culturelle, la forêt de Mikea est parmi les régions de Madagascar qui suicite autant d'intérêt du point de vue biodiversité. Les études qui ont été menées dans la région et les informations y afférentes soient bien que nombreuses et intéressantes, soient éparpillées, soient non disponibles.

D'après les résultats de recherches et de priorisation, la Région a été classée comme zone prioritaire par sa biodiversité unique notamment par la présence de deux espèces d'oiseaux qui y sont endémiques: le *Uratelornis chimaera* et le *Monias benschi* (ZICOMA 2000) et deux espèces de micromammiféres: *Microgale jenkinsae* et *Macrotarsomys petteri* (Goodmann & Soarimalala 2004, 2005). Mais cette zone n'a jamais disposé une structure légale de protection (Plan GRAP 1989) ce qui a entraîné les différentes équipe de recherche à la proposer pour une proposition de la conservation du grand bloc au nord de la rivière de Manombo (Seddon 2000).

Objectif

Le présent inventaire botanique figure dans le plan d'action du Programme Ala Maiky du WWF à Madagascar. L'objectif principal est de fournir des informations biologiques et écologiques de base à jour et fiables pour une éventuelle élaboration d'une stratégie de conservation de la biodiversité de la forêt de Mikea. La présente étude cherche en effet à identifier les habitats, à caractériser la flore et la végétation de cette région, mais elle vise aussi à étudier la distribution des espèces s'y trouvant, afin de pouvoir déterminer les aires de conservation susceptibles d'assurer la représentativité et la viabilité de la diversité biologique et écologique de la forêt de Mikea

Elle est surtout focalisée à l'étude de la variation de la structure et de la composition floristique de la forêt des Mikea. De plus, il va permettre de:

- fournir des informations sur la diversité floristique et les habitats naturels de la région afin d' appuyer l'orientation des activités et interventions en matière de conservation.
- fournir des données de base nécessaire pour l'élaboration d'un futur programme de suivi écologique.
- délimiter l'aire prioritaire et identifier les cibles de conservation (espèces, habitats ou aires) du sous-région pour une action de conservation.

Ainsi ces donnés sont indispensables pour répondre à l'objectif de délimitation des aires de conservation :

− La biodiversité et les différents types d'habitats existants de la région écologique y sont-ils bien représentés ?

− Est-ce qu'elle est représentée par des populations viables ?
− Ces habitats sont-ils relativement larges et en bon état pour assurer la viabilité des populations ?−
− Les Connaissances acquises sur chaque zone prioritaire sont-il suffisantes ?

Méthodologie

1. Choix des sites

La zone d'étude, la forêt de Mikea qui constitue un grand bloc de forêt est située entre la rivière de Fiherenana au sud et Mangoky au nord. Les inventaires se sont déroulés entre la Mangoky et le Manombe (nord de Fiherenana). Pour la localisation des sites d'inventaires, une carte très simplifiée a été établie à partir de l'image satellite 2000 (habitats selon le concept WWF Ala maiky) (fig. 1). Elle nous a permis de tracer les bandes de transects traversant la zone d'est en ouest et couvrant le nord et sud. Ainsi, 5 transects ont été proposées pour mener les inventaires biologiques du Nord au sud (fig. 1). Les sites d'inventaires ont été pris à l'intérieur de chaque type formation (habitat). Au moins 3 sites par bande de transect (soit un site par habitat) ont été priorisés.

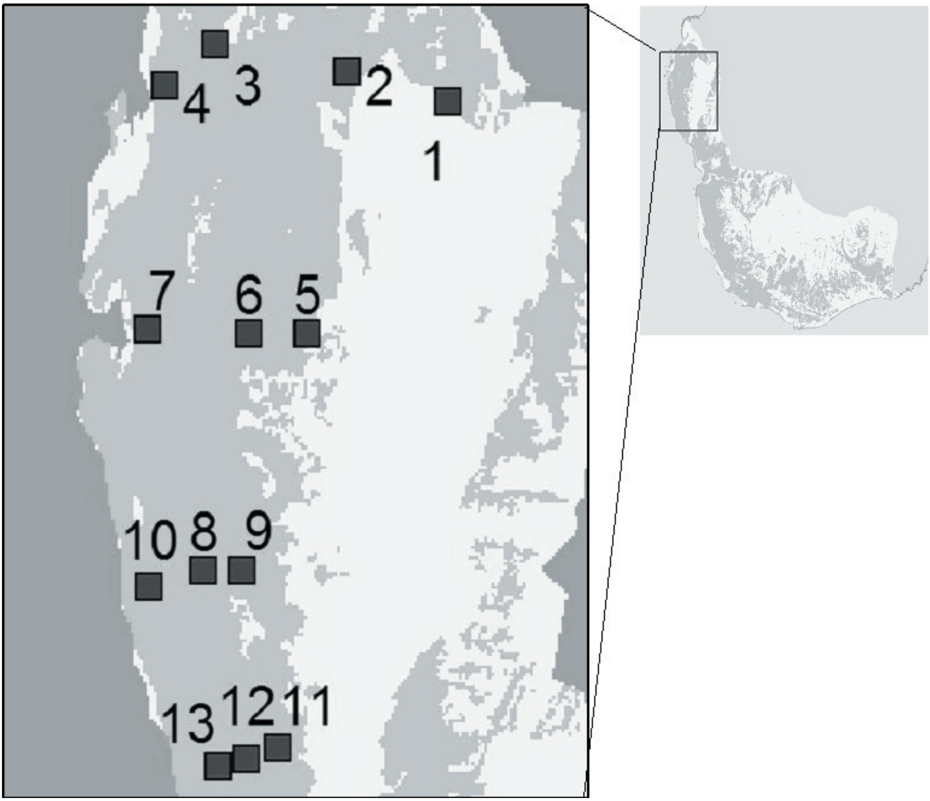


Fig. 1 La carte montre les sites des collectes de données dans les 13 sites d'étude sur la couverture forestière actuelle dans la région des Mikea

2. Relevés botaniques

L'écologiste compte sur les échantillonnages pour fournir une idée de la composition de la communauté et il est rarement possible de recenser tous les individus dans une communauté (Magurran 1988). Ainsi, des «parcelle-transects», non permanentes, de 50m de longueur sur 2 m de large (100m²) on été mises en place afin de décrire la flore et la végétation (structure) de la zone (Gentry 1982). Tous les arbres ayant leurs racines dans la parcelle-transect et dont les diamètres à la hauteur de la poitrine (dhp) (à 1.3m du sol) ≥2.5cm sont mesurés et recensés. Leurs hauteurs sont mesurées ou estimés. La valeur 2.5cm a été choisi suite aux différents études déjà entreprise dans les mêmes formations dans le sud (Rakotomalaza *et al*. 1999. En ce qui concerne les petits arbustes et les herbacés moins de 1.3m de hauteur et de dhp <2.5cm, nous avons choisit la méthode de transect linéaire de 50m (ligne droite suivant le centre du transect- parcelle), ou toutes les espèces qui touches la corde (chevillère) sont recensées. Pour faciliter l'identification sur terrain, nous avons surtout utilisé le terme de «morpho-espèce» (le botaniste assume que deux pieds identiques morphologiquement appartiennent à une même espèces en l'absence d'un appareil reproducteur, les différentes parties de la plantes pourront être utilisée pour l'identification).

Comme on rencontre des plantes dont l'identifications pose des problèmes, nous avons employé différents noms selon le degrés de connaissance, certaine sont complètement inconnues, d'autres peuvent être identifiée juste au niveau de la famille.

3. Collecte d'échantillons

Bien que la plupart des plantes recensée aient nommé par leurs nom vernaculaire, la majeur partie des espèces rencontrées ont été collectées, un échantillon pour les individus stériles et au moins trois pour les individus fertiles. Des collectes itinérantes permettent aussi d'avoir des échantillons herbiers de références et aideront à l'identification des pieds stériles recensés dans les «parcelle-transects». Ces échantillons sont identifiés aux herbiers d'Antananarivo (TAN Tsimbazaza et TEF FOFIFA Ambatobe). Un spécimen de chaque échantillon est envoyé au Muséum National d'Histoire Naturelle (MNHN) à Paris pour une expertise.

4. Collecte d'échantillon de sol

Pour chaque site étudié, des échantillons de sol ont été collectés suivant un trou de 10x10x10cm (sans la litière) et sont analysés au laboratoire du Centre National de Recherche pour l'Environnement (CNRE).

5. Analyses

a. Courbe aire- espèce - La question qui se pose est «Quelle quantité de données doit-on collecter pour avoir un échantillon[1] représentatif de la végétation du site» (White & Edwards 2000). Une courbe aire-espèce donnent une information sur l'homogénéité du groupement étudié. Ainsi quand la courbe atteint un plateau, on suppose que la taille de l'échantillonnage est suffisante, c'est à dire que même en augmentant la surface étudiée, la chance de rencontrer une nouvelle espèce est trop faible.

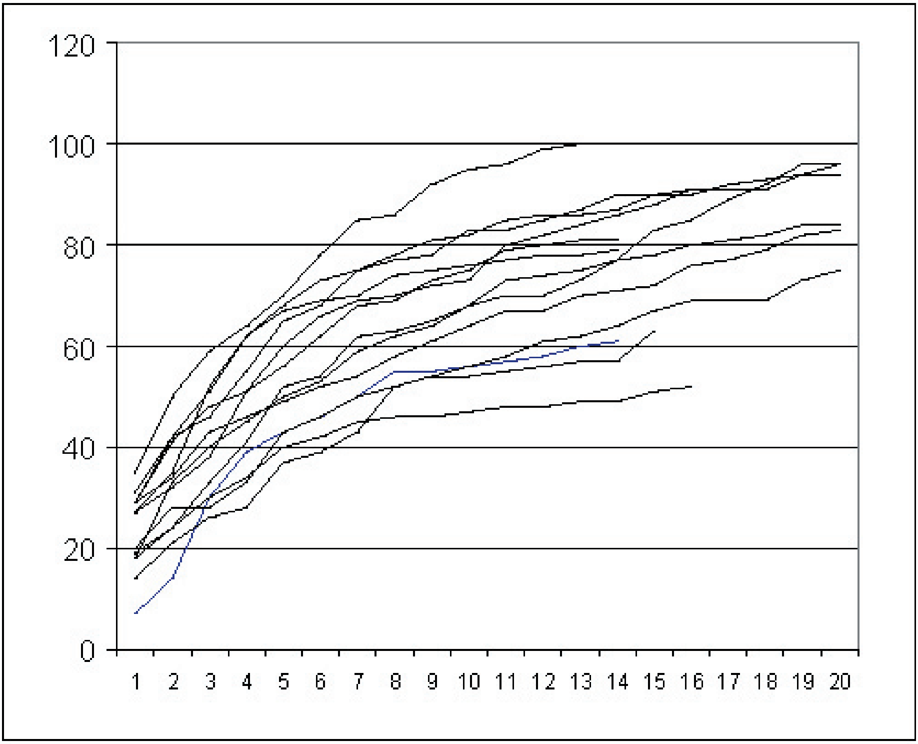


Fig. 2 Courbe aire-espèces des 13 sites. Pour la plupart des sites d'inventaire, les courbes aires espèces atteignent (ou presque) l'asymptote (plateau) ie montre que l'échantillonnage est complet.

b. Distribution de la hauteur - L'histogramme de la distribution de la hauteur permet d'avoir une idée sur la structure verticale de la formation étudiée (profil de la végétation). Les valeurs sont groupée par intervalle de 2.5m. Nous avons choisit arbitrairement 11 classes selon nos reconnaissances bien que théoriquement les fourrés et les forêts denses sèche du sud-ouest dépassent rarement les 20m de hauteur.

c. Distribution des DHP - La distribution du nombre d'arbre et arbuste de diamètre ≥ 2.5 cm facilite la compréhension de la structure verticale de formation étudiée. Elle permet aussi d'évaluer certains paramètres comme la surface terrière. Dans notre étude elle est représentée sous forme d'histogramme ou les valeurs sont regroupées en classe par intervalle de 2.5 cm.

d. Densité - La densité représente le nombre d'individu recensé par unité de surface.

e. Aire basale (surface terrière) et Dominance relative - En utilisant les dhp, on peut avoir l'aire basale des espèces genres et famille donnant ainsi l'occupation terrière dans la forêt.

f. Fréquence - La fréquence correspond au nombre d'occurrence d'une famille, genres et espèces dans le parcelles considérées. Ceci permet d'évaluer l'apparition d'une espèce

dans les différents sites. Elle peut alors nous orienter sur plusieurs information : espèces indicatrice, méthode de collecte de donnée, itinéraire de récolte botanique à faire.

g. Indice de Valeur d'Importance (IVI) - C'est une indice qui met en évidence (somme) l'abondance relative, la dominance relative et la fréquence relative des espèces.

h. Analyse de similarité et de dissimilarité - L'analyse de similarité entres les différents sites ont employé d'un la présence et absence des espèces utilisant ainsi l'indice des similarité de Jaccard et en considérant les autres paramètres (densité, fréquence et abondance) pour l'IVI.

i. Indice de diversité Shannon-Weave H' - Pour l'uniformité et la distribution des espèces au sein de l'habitat, nous avons utilisé l'Indice de Shannon qui est calculé à partir des données quantitative.

j. Indice de similarité de Horn : R_0 - Indice qui utilise l'indice de diversité de Shannon et permet de comparer la ressemblance deux communautés (Brower *et al.* 1990). La valeur de R_0 est comprise entre 0 (aucune similarité) et 1 (« identique »).

k. Analyse multivariable - Le logiciel Community Analysis Package (CAP) a été utilisé pour l'analyses multivariable et pour le dendrogramme. Les Test de Mantel fournissent une autre analyse qui étudie la corrélation entre la dissimilarité en composition spécifique et la dissimilarité entre les variables environnementales mesurées aux sites. L'avantage de ceci est qu'ils sont des régressions non paramétrique, ainsi il est possible d'enlever l'influence d'autres variables en calculant des coefficients de régression.

Les sites de recherches

A part la bande de transect qui se trouve à l'extrême nord de la zone d'étude et qui a 4 sites d'études, les 4 restantes ont toutes 3 sites d'études. Treize sites ont été prospectés au cours de cet inventaire biologique (Tableau 1). Ils sont couverts en grande partie par une forêt sèche poussant sur des différents types de sols (tableau 5 et 6).

Les tableaux 1 et 2 donnent une récapitulation des données concernant les différentes sites de relevés et les graphes de la fig. 6 renseigne plus sur les structures (hauteurs et diamètres).

<u>Site 1 : Mahavozobe</u>

Ce site peut être considéré comme le coin nord est du lac Ihotry. De Type forêt dense sèche caducifoliée de l'ouest, on rencontre les 3 espèces de Baobab en même temps (*Adansonia grandidieri*, *A. za* et *A. rubrostipa*). Cela explique la complexité du site car l'*A. grandidieri* (Reniala) est inféodé à la région ouest entre Morondava. L'*A. za* (za) se trouve surtout entre sur du sable roux entre Befandriana sud à Taolgnaro et l'*A. rubrostipa* (Fony) se développe surtout sur du sable dûnaire plus ou récente (sable beige).

Tableau 1 Récapitulatif des sites

N° Site	Nom du site	Proche village	Commune	Lat	Long	Localité	Type de la formation
Site 1	Mahavozobe	Mahavozobe	Nosy-Ambositra	21°56'08.1	043°49'17.7	E	FDS de l'ouest
Site 2	Marihy	Marihy	Basibasy	21°52'09.3	043°28'35.3	CE	FDS de l'ouest
Site 3	Mamono	Mamono	Morombe	21°48'22.3	043°27'51.8	CW	Forêt de transition
Site 4	Ankotapiky	Ankotapiky	Morombe	21°52'05.3	043°21'16.1	W	Forêt de transition
Site 5	Vorehy	Vorehy	Basibasy	22°16'04.7	043°38'04.3	E	Forêt de transition
Site 6	Andaldomo-Antsonobe	Entre Vorehy et Ankindranoky	Basibasy	22°12'28.4	043°28'15.3	CE	Forêt de transition
Site 7	Ankindranoky	Ankindranoky	Morombe	22°12'34.9	043°18'54.6	W	Forêt de transition
Site 8	Andalambazaha	Analabo	Analamisampy	22°32'09.3	043°28'35.3	E	Forêt dense sèche de l'ouest
Site 9	Mitsinjo be	Entre Analabo et Salary	Analamisampy	22°31'59.8	043°24'46.6	C	Forêt de transition
Site 10	Ankilitelo	Salary	Salary	22°33'16.3	043°19'39.6	W	Forêt de transition
Site 11	Ankazomafio	Ankatepoky	Ankililoka	21°54'44.9	043°47'59.8	E	Forêt de transition
Site 12	Andalan'i Morombe	Entre Ankatepoky et Tsifota	Ankililoka	22°47'21.5	043°28'48.2	C	Forêt de transition
Site 13	Abrahama -Jilorika	Tsifota	Manombo	22°47'58.4	043°25'57.7	W	Forêt de transition

Tableau 2 Résumés des valeurs des 13 sites d'études dans la forêt des Mikea

Site	Nb de pied recensé	Nombre de pieds par ha	Moyenne de dhp	Moyenne de hauteur	Aire basale (cm²)	Nombre de famille	Nombre de genre	Nombre d'espèce
Site 1	674	4814	7,83 ± 20,57	5,15 ± 2,43	19352,21	29	44	61
Site 2	1199	5021	6,61 ± 3,89	4,99 ± 2,63	36918,62	31	46	59
Site 3	1306	4065	6,21 ± 5,45	4,64 ± 3,64	31941,36	25	40	52
Site 4	1399	5071	6,92 ± 7,47	4,29 ± 2,85	59668,01	33	57	75
Site 5	1281	5577	4,90 ± 5,47	4,16 ± 2,27	24391,91	44	71	83
Site 6	703	6285	6,74 ± 7,66	4,95 ± 2,19	56640,36	36	66	80
Site 7	691	6692	6,03 ± 7,85	3,35 ± 1,53	62970,67	39	79	100
Site 8	862	6867	5,48 ± 16,62	4,67 ± 1,46	82782,48	39	66	91
Site 9	725	5375	10,29 ± 17,51	4,81 ± 3,29	36134,63	41	68	84
Site 10	817	5995	4,78 ± 8,34	3,55 ± 3,36	54798,64	46	76	96
Site 11	870	6530	4,18 ± 5,43	4,65 ± 2,39	38648,32	39	69	96
Site 12	1236	6995	7,50 ± 10,63	4,35 ± 3,39	263204,8	39	74	94
Site 13	1075	6405	6,24 ± 7,76	4,49 ± 3,29	136651,1	36	64	83

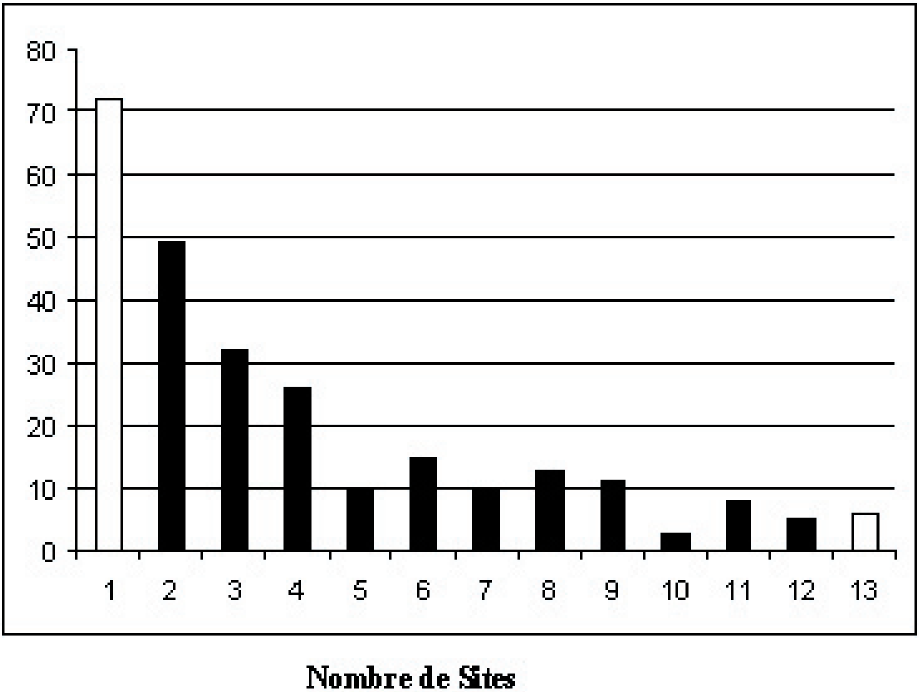


Fig. 3 Nombre de sites où les espèces sont rencontrées. Cette figure montre que plus de 70 des 260 espèces (Site 1) recensées dans cette études se rencontre seulement dans un des 13 sites. Seulement 6 espèces (Site 13) se rencontre dans tous le sites

<u>Site 2 : Marihy</u>
Ce se trouve sur la rive nord du lac. C'est une forêt sèche sur sable roux. Les zones assez humides et riches en humus sont couvertes par des forêts dominées par des grands arbres avec des lianes On y rencontre encore les trois espèces de Baobab mais la densité de l'A. grandidieri diminue considérablement. Mais plus au sud, sur la rive ouest du lac, on rencontre une formation à fort densité d'A. grandidieri. La forêt est toutefois fragmentée et régénérée en grande partie.
<u>Site 3 : Mamono be</u>
Le nom signifie: qui tue les grands . Le nom signifie que l'endroit a été auparavant infesté crocodile qui non seulement attaquait les petit zébu mais arrivait à tué les grand castré. Le site se trouve à cheval sur du sable blanc et du sable roux..
<u>Site 4 : Ankotapiky</u>
Il constitue le coin nord ouest de la zone d'étude. Le fourré est remplacée brusquement par la mangrove qui est encore plus ou moins en bonne état. Il s'agit d'un haut fourré sur sable roux à blanchâtre. Le sous bois est dense souvent impénétrable. C'est une zone peu dégradée.

Site 5 : Vorehy

C'est une forêt dense sèche sur sol sableux de couleur rouge. Le sol est riche en humus. La forêt est très fragmentée et perturbée. Vorehy est considéré comme le capital des Mikea. La partie est de cette zone est sujette aux défrichements pour la culture des maïs surtout. Dans cette région, les missionnaires sont en train d'évangéliser la Mikea et de les sortir de la forêt.

Site 6 : Antsonobe

Ce site se trouve sur la route entre Vorehy et Ankindranoky. C'est une forêt dense sèche sur sol sableux rouge de hauteur qui peut atteindre jusqu'à 20m. La forêt est très fragmentée et perturbée. En effet, elle est principalement utilisée pour exploitation forestière (parfois illicite) et terrain de cultures. Ce qui entrain qu'il reste un très mince frange de cette type d formation dans la région.

Site 7 : Ankindranoky

Comme le site 4, le fourré est remplacé à l'ouest par la mangrove. Il s'agit d'un haut fourré sur sable roux à blanchâtre. C'est une zone peu dégradée. Mais des exploitation du côté de Vorehy commence à exploiter.

Site 8 : Andalambazaha

Comme Vorehy, la région enregistre une forte taux de dégradation encore due à la culture de maïs. Il ne reste plus que des reliques de forêts denses sèches, ou la hauteur peut atteindre plus de 12m.

Site 9 : Mitsijo-be

Ce site se trouve sur la route entre Salary et Analabo. Haut fourré sur sable roux la formation est plutôt utilisé pour subvenir au besoin locaux en ressource ligneuse et autres produits secondaire.

Site 10 : Ankilitelo

La formation par le bush sur sable blanc dominé par l'*Euphorbia stenoclada.* C'est une formation sur calcaires et par endroit des zones a sable brun ou des cultures de maïs sont possible.

Site 11 : Ankazomafio

Elle est assez fragmentée, sujette aux différents exploitations illicites et coupes sélectives. Une grande partie est détruite pour les cultures sur brûlies. C'est une forêt sèche caducifoliée sur sol sableux de couleur rouge.

Site 12 : Andalan'i Morombe

Le site se trouve dans un zone à relief plus ou moins accidenté ou l'on rencontre en même temps du sable brun et des poches de calcaires et des vallée. Ce qui entraîne que l'on peut rencontrer différents types de formation : de la forêt dense sèche continuation de la formation de l'ouest, des fourré xérophile de l'ouest et du haut fourré, formation de passage entre les deux précédentes.

Site 13 : Abrahama -Jilorika

Il s'agit d'un Haut fourré sur sol sableux de couleur roux à blanchâtre. Le bas fond est riche en sol alluvionnaire et est dominé par des grands arbres de plus de 15m (émergent) et la canopée a une hauteur moyenne de 12m. La gestion de la forêt et du marais d'Anjavazaha (trouve à 2km de Tsifota, un village de pécheur) est transféré aux communautés locaux (Gestion Locale Sécurisée ou GELOSE).

Résultats et interprétations

Quatre bandes transects ont été étudiés (fig. 1). Les noms de villages, des forêt et les coordonnées des sites d'études sont donnés (tableau. 1). Deux cent vingt et un parcelle-transects non permanentes ont été mise place, donnant au total une surface de 23100m² (2.31 ha).

Les courbes aires-espèces (fig. 2) montre que la plupart des courbes atteignent l'asymptote c'est à dire les nombres de transect mis en place sont suffisante et sont représentatifs et que les résultats permettent de faire les comparaisons et de mieux comprendre la structure et la flore de chaque formation.

Ainsi, 12838 pieds de plantes ont été recensées avec un total 69 familles, 166 genres reparties en 283 morphoespèces ont été recensées lors de cette étude (tableau. 2 et 3)

1. Relevé botanique

Les caractéristiques étudiés (tableau 2, fig. 2):

a. Densité et aire basale(surface terrière)
b. Le nombre de pieds recensé varie de 6995 pieds par ha (site 12) à 4065 pieds par ha (site 3).
c. Pour la surface terrière, elle varie de 3613m² (site 9) à 243m² (site 5).
d. Distribution des dhp
e. Sur les 12838 plantes recensées, 10636 ont un dhp≥2.5. Sur la totalité des 13 sites, plus de 50% des arbres et arbustes ont des dhp comprise entre 2.5 et 7.5 cm (fig. 4) et le reste dépend de la formation. Pour les formation forestière les arbres et arbustes sont groupés au-dessus de ces valeurs et pour les fourré en dessous. A part les sites 3, 5 et 11 ont peut rencontrer des dhp qui dépassent 32.5cm (limite maximum pris arbitrairement) et représenté par de nombreuse espèces en forme de bouteille ou de cigare (adaptation contre les pertes d'eau par évapotranspiration).
f. Distribution des hauteurs

Plus de 50% des arbres et arbuste ont un hauteur entre 2.5 et 7.5m (fig.3). Selon la formation, le canopée se trouve entre 12 et 15m (sites 3, 4, 5, 10 et 13) et entre 15 et 17m pour le reste.

Tableau 3 Tableau récapitulatif des valeurs d'analyse. N = Nombre total des individus; H' = Indice de diversité de Shannon

Sites	Site1	Site2	Site3	Site4	Site5	Site6	Site7	Site8	Site9	Site10	Site11	Site12	Site13
Total recensée	215	229	243	343	265	408	427	474	477	406	541	558	473
Moyenne	15.36	15.27	15.19	17.15	18.93	29.14	30.50	26.33	23.85	20.30	27.05	27.90	23.65
Ecart-type	4.73	4.46	5.43	4.92	4.62	3.25	4.47	3.18	2.83	2.99	5.61	5.14	4.07
N	674	703	691	862	725	817	870	1236	1075	1199	1306	1399	1281
H'	1,51	1,48	1,44	1,56	1,56	1,64	1,73	1,68	1,64	1,61	1,69	1,66	1,59

Tableau 4 Tableau de similarité de Jaccard

Sites	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13
S1	-	-	-	-	-	-	-	-	-	-	-	-	-
S2	0,5289	-	-	-	-	-	-	-	-	-	-	-	-
S3	0,4779	0,6429	-	-	-	-	-	-	-	-	-	-	-
S4	0,5294	0,5778	0,6929	-	-	-	-	-	-	-	-	-	-
S5	0,4037	0,4259	0,42	0,4553	-	-	-	-	-	-	-	-	-
S6	0,5487	0,4464	0,5	0,5197	0,58	-	-	-	-	-	-	-	-
S7	0,3942	0,4853	0,5781	0,6358	0,4839	0,5625	-	-	-	-	-	-	-
S8	0,4154	0,4186	0,4463	0,4583	0,4786	0,5455	0,469	-	-	-	-	-	-
S9	0,4298	0,4333	0,5	0,5037	0,5	0,5714	0,6029	0,7597	-	-	-	-	-
S10	0,378	0,3651	0,4576	0,5106	0,4386	0,4915	0,507	0,563	0,6508	-	-	-	-
S11	0,3971	0,4741	0,4724	0,5333	0,4878	0,4567	0,5033	0,6528	0,5926	0,5248	-	-	-
S12	0,3944	0,4113	0,406	0,4872	0,4341	0,4962	0,5478	0,6267	0,7092	0,5714	0,6795	-	-
S13	0,381	0,416	0,4615	0,5429	0,4425	0,4444	0,4965	0,5075	0,624	0,6412	0,6	0,7123	-

Tableau 5 Matrice de valeur des indices de similarité de Horn

Ro HORN	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11	Site 12	Site 13
Site1	1	0,53	0,43	0,47	0,32	0,42	0,26	0,30	0,28	0,26	0,28	0,25	0,23
Site2	-	1	0,67	0,54	0,47	0,38	0,35	0,29	0,32	0,31	0,32	0,32	0,38
Site3	-	-	1	0,62	0,31	0,34	0,45	0,25	0,35	0,37	0,23	0,33	0,43
Site4	-	-	-	1	0,34	0,44	0,58	0,33	0,42	0,48	0,32	0,45	0,57
Site5	-	-	-	-	1	0,54	0,40	0,38	0,36	0,27	0,42	0,31	0,28
Site6	-	-	-	-	-	1	0,51	0,44	0,36	0,29	0,48	0,39	0,35
Site7	-	-	-	-	-	-	1	0,37	0,47	0,39	0,39	0,51	0,56
Site8	-	-	-	-	-	-	-	1	0,64	0,48	0,60	0,55	0,44
Site9	-	-	-	-	-	-	-	-	1	0,63	0,54	0,60	0,55
Site10	-	-	-	-	-	-	-	-	-	1	0,48	0,60	0,60
Site11	-	-	-	-	-	-	-	-	-	-	1	0,64	0,47
Site12	-	-	-	-	-	-	-	-	-	-	-	1	0,76
Site13	-	-	-	-	-	-	-	-	-	-	-	-	1

2. Relevé botanique

Au total 69 familles, 166 genres reparties en 283 morpho-espèces ont été recensées lors de cette étude. Des collectes itinérantes permettent d'avoir des échantillons herbiers de références ont été effectuées et ces échantillons ont pu aider à l'identification des pieds stériles recensés dans les « parcelle-transects».

3. Collecte de sol

Vingt six échantillons ont été collectés par les deux équipes. Les résultats des analyses montre les variations de structures et de compositions (tableau 6 et 7).

4. Analyse

Parmi l'objectif de l'étude est de vérifier la variation latitudinale et longitudinale de la structure et de la composition spécifique de la région des Mikea, d'autre analyse ont été mené. « L'analyse groupante » a utilisé en considérant la présence et absence (P/A) des espèces d'un côté et de l'indice de la valeur d'importance (IVI) de l'autre côté. Pour l'influence des autres facteurs environnementaux, le résultat des analyses du sol ont été utilisés pour l'étude de la relation entre ces facteurs.

Comme première observation, plusieurs sites sont groupés ensemble indépendamment de l'analyse (sites 3 et 4; sites 8 et 9; sites 12 et 13) (fig. 1). Ceci est du aux choix des sites et à la continuité des habitats qui sur cartes ont été séparer arbitrairement.

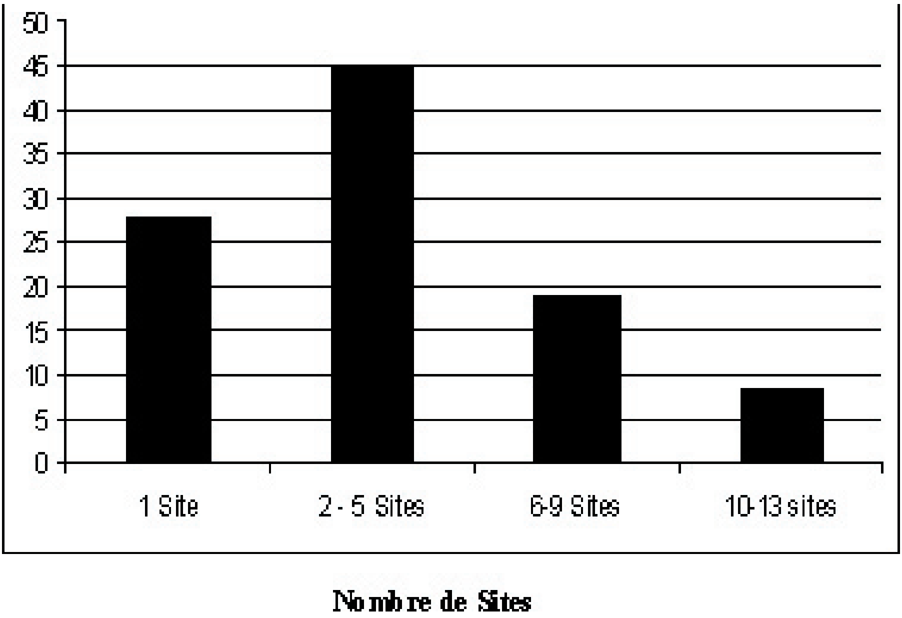


Fig. 4 Nombre de sites où les espèces sont rencontrées. Cette graphe montre que 27 % des espèces recensées dans cette étude sont rencontrées seulement dans un des 13 sites. Seulement 8% des espèces se rencontrent dans tous les 13 sites. Ainsi, chaque site étudié renferme un composition spécifique propre.

Tableau 6 Résultat d'analyse d'échantillon de sol (Forêt des Mikea)

N°	Echantillon	pH (H_2O)	pH ($CaCl_2$)	Argile (%)	Limon (%)	Sable (%)	Couleur
1	# 1	6	6,2	4,3	6	86,7	Noir Brun
2	# 2	5,2	5,4	3,6	5,2	90	Noir
3	# 3	5,4	5,4	2,1	5,4	91	Beige
4	Pitfall line 4	6,7	7	2	4	92	Rouge
5	Pitfall line 5	5,9	6,3	4,5	6	88	Rouge
6	Pitfall line 6	6,2	6,5	3,2	5,4	90	Rouge
7	Pitfall line 7	5,4	5,2	5,8	4,8	87,5	Rouge Marron
8	Pitfall line 8	5,9	5,5	3,7	5,2	90	Marron
9	Pitfall line 9	6,3	6,4	4,4	3,2	91	Rouge
10	Pitfall line 10	6,1	6	6	3,4	88,95	Brun
11	Pitfall line 11	5,9	6	4,8	4	89	Marron Clair
12	Pitfall line 12	5,6	5,7	4,4	4,65	90	Brun Clair
13	Pitfall line 13	7,1	7,3	3,3	2,8	91,45	Brun Marron
14	Pitfall line 14	5,7	6	5,2	4,2	87,25	Brun Marron
15	Pitfall line 15	6	6,2	5,4	2,23	87,9	Marron Clair
16	Pitfall line 16	5,2	5,4	4,2	3	90,5	Gris Clair
17	Pitfall line 17	5,7	5,5	3,8	4	87	Gris Foncé
18	Pitfall line 18	5,5	5,7	4,8	4,25	87,25	Gris Brun

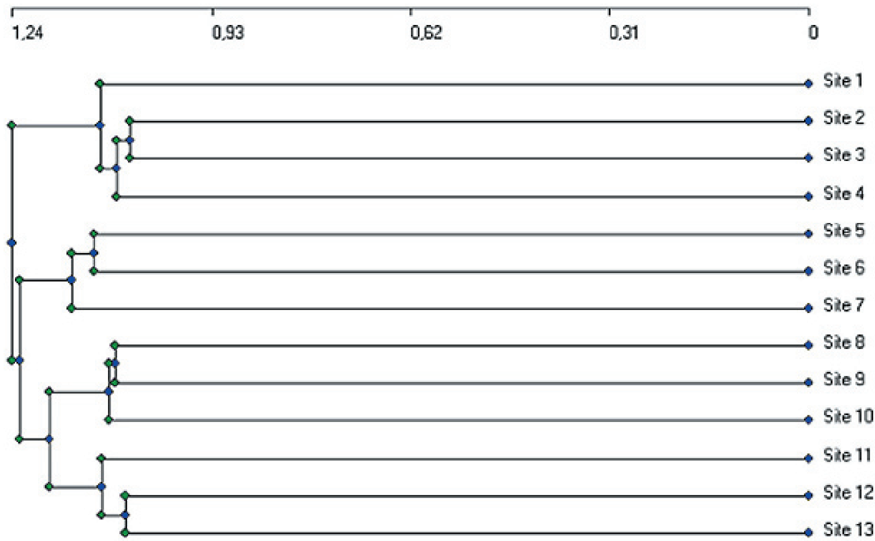
Tableau 7 Résultat d'analyse d'échantillon de sol (Forêt des Mikea [Coca])

N°	Echantillon	pH (H_2O)	pH ($CaCl_2$)	Argile (%)	Limon (%)	Sable (%)	Couleur
19	S2 :Vallée	6,8	6,7	4,4	4,2	90	Brun
20	S2 :Plateau	6,5	6,6	3,9	5,8	88	Brun Clair
21	S4 : Dalle Calcaire	7	7	6,8	8,5	77	Gris
22	S4 :Sable	6,3	6,5	4,8	4,7	89,5	Marron Clair
23	S5 :Vallée	6,8	6,8	6,15	6,8	86	Brun
24	S5 :Plateau (Sommet)	5,4	5,7	4,95	5	89,5	Brun Clair
25	S6 :X2	5,4	5,6	4,1	6,7	90	Rouge Brun
26	S6' :X2	5,2	5,4	7,35	5,8	86	Rouge Clair

Avec les analyses groupantes, on note des différences principales: Deux sites ne sont pas groupés avec d'autres en utilisant IVI, mais ne sont pas tout à fait distinct en utilisant la présence/absence (site 6 et 11) (fig. 1). Les groupes ne se joignent pas au même niveau entre les analyses (groupe 8 et 9 et groupe 12 et 13). Par exemple, le groupe 8 et 9 et le groupe 12 et 13 se joignent en premier en utilisant l'IVI, mais en utilisant la présence / absence, le groupe 8 et 9 se joint au groupe 10 avant de se joindre au groupe 12 et 13 (qui contient déjà le site 11 en utilisant P\A mais pas l'IVI) (fig. 5).

Plus en détail: site 5 est groupé avec le site 6 en considérant P\A mais groupes avec le site 2 IVI employant (et se joint alors à 6). Site 2 est groupé avec le site 5 en utilisant IVI, mais se groupe avec les sites 3 et 4 P\A (et se joint au site 5 plus tard). Les sites 3, 4 et 7 ont un commutateur de niveau plus élevé, comme rapporté ci-dessus. Quand les sites sont groupés dans juste deux groupes (2 groupes de niveau), ces sites groupent plus étroitement avec d'autres sites du nord (1, 2, 5, 6) employant P\A mais groupent plus étroitement avec les sites occidentaux (8-13) employant IVI.

Fig. 5 Dendrogramme de similarité utilisant CAP



Site 10 groupe premier avec les sites 3 et 4 employant IVI, mais grouper d'abord avec des sites 8.9 utilisant P\A (et est dans un groupe différent au niveau de 2 groupes que des sites 3.4 P\A employer). Site 11 marque un commutateur qui est reflété à des niveaux plus bas et plus élevés. En utilisant IVI, il se lie en premiers lieu avec le site 6 (bien que tous les deux soient distincts au niveau de 7 groupes) et au niveau de 2 groupes il est groupé avec les sites orientaux (1.2.5.6). Mais en utilisant P\A, il groupe rapidement avec les sites 12.13 (et n'est pas distinct au niveau de 7 groupes) et est groupé ainsi avec les sites méridionaux (8.9.10.12.13) au niveau de 2 groupes

Analyse de la similarité et similarité en composition spécifiques entre sites

Pour la dissimilarités on peut constater qu'en utilisant l'IVI, peu des sites ont plus de 50% de similarité (seulement sites 8 et 9 et sites 12 et 13) (tableau. 4 et 5). Pour la P\A, comme les dissimilarités sont généralement faibles, beaucoup de sites ont plus de 50% de similarité (10 paires). Mais les sites 1, 2, 5 et 6 ne sont pas 50% ou plus semblables à aucun autre site.

En conclusion, en utilisant des techniques telles que des analyses groupantes pour la planification de conservation, nous devons considérer que quoique des sites puissent être groupés ensemble, il y aura toujours des espèces qui ne sont pas trouvées dans tous les deux. En fait, dans la région de Mikea, 1/3 des espèces sont trouvés seulement dans un site et tout sauf un site contiennent les espèces qui sont trouvées seulement du fait site (tableau 8).

L'analyse basée sur présence/absence traite toutes les espèces d'une manière égale, sans considérer l'abondance ni la fréquence. Ceci augmente l'importance des espèces rares qu'en utilisant l'IVI. Par conséquent, on peut constater un gradient Nord

Sud des distributions d'espèces (les espèces tendent à lâcher pendant qu'on va nord ou sud, mais pas autant à est ou à l'ouest). Puisque l'IVI ne pèse pas des espèces rares fortement. La tendance longitudinale des groupes reflètent un différence majeur dans la composition des communautés, ou une communauté est définie par les espèces les plus abondantes et fréquentes.

Relation entre composition spécifique et environnement

L'analyse sur les relation entre composition spécifique et environnement n'inclue pas les sites 1, 3 et 6 parce qu'elles n'ont pas eu des données de sol.

La latitude, la longitude les données du sol (tableau 6 et 7) ont tous des corrélations fortes avec une ou plusieurs axes pour les deux paramètres (P\A et IVI). Le sable également est corrélé avec axe en utilisant P\A.

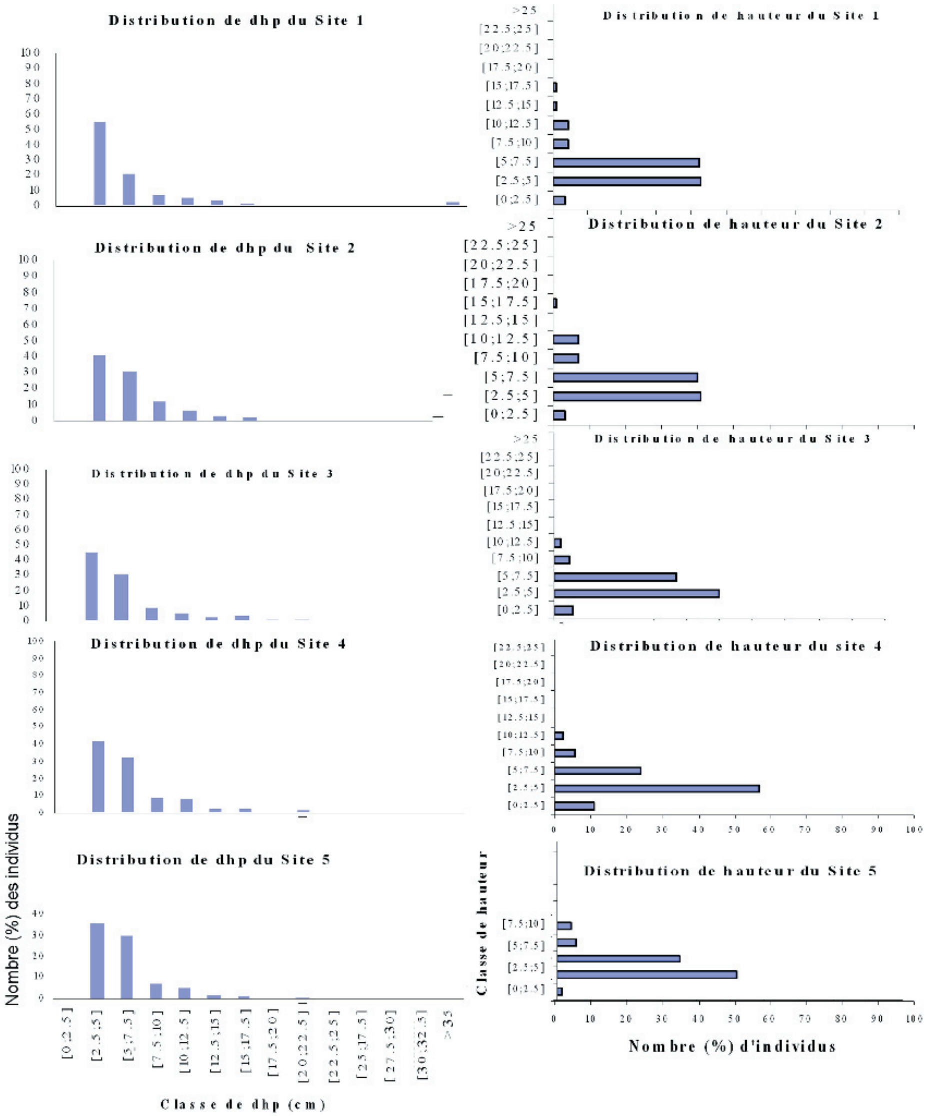
La classification en utilisant IVI seulement produit 2 axes. La longitude et les CECT ont été fortement corrélés avec les premières axes, alors que la latitude, le Limon, les B.D., les K_2O, les CECT, le C, les P_2O_5 et les CN étaient fortement corrélés avec la seconde. En utilisant P\A, la classification a produit 3 axes. La plupart des variables sont fortement corrélées avec 2 (B.D, K_2O, CECT) ou 3 variables (latitude, Limon, P_2O_5, MgO). La longitude et le Sable ont été corrélés seulement avec axe.

Les Test de Mantel ont prouvé que la dissimilarité d'espèces basée sur P\A est fortement corrélée avec la latitude et la longitude (au degré à peu près identique). Test basés sur IVI également montre une corrélation modérée avec la latitude et une forte corrélation avec la longitude.

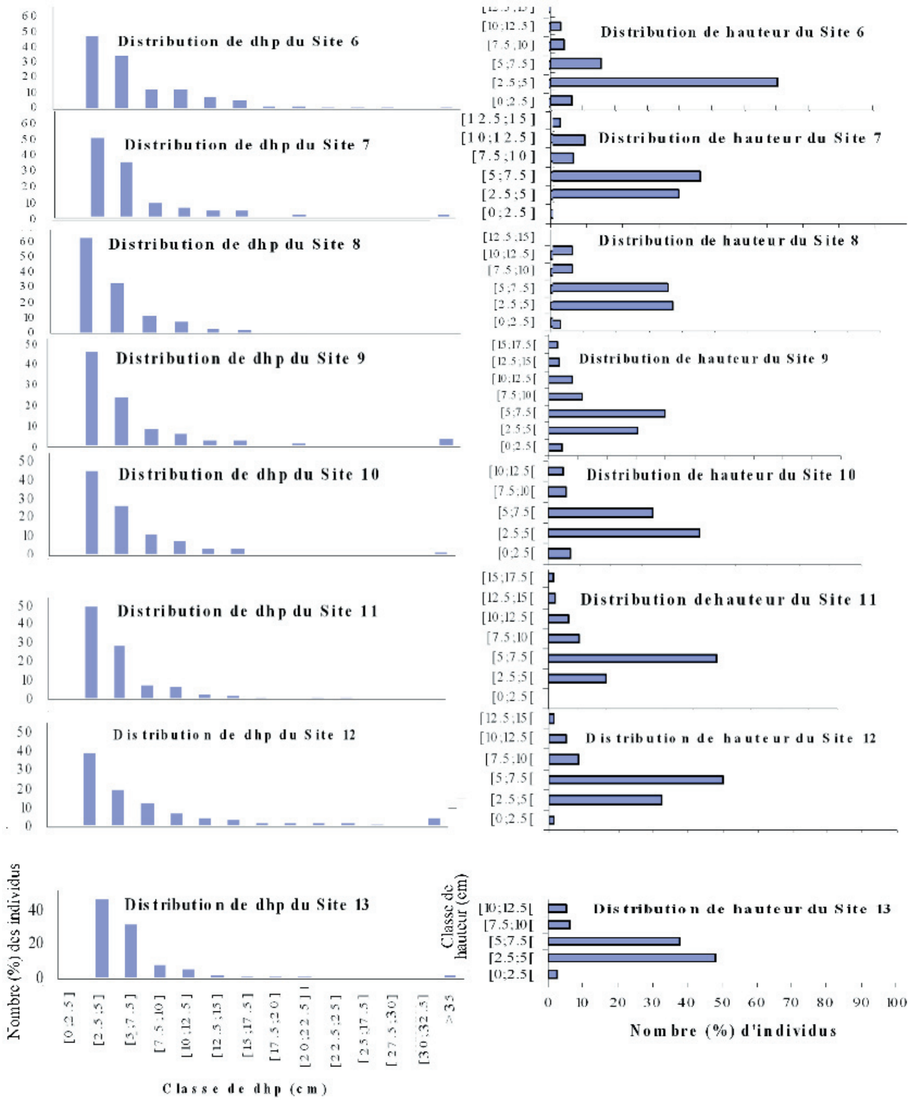
Tableau 8 D'après cette table, on peut voir pourquoi quelques sites, tels que le site 1 n'ont été groupés avec aucun autre site dans le dendrogramme et comment la similarité entre certains sites (site 11) change entre l'utilisation P\A et IVI.

	PA			IVI		
	ave	min	max.	ave	min	max.
Total	0.50	0.26	0.64	0.70	0.25	0.86
1	0.57	0.46	0.63	0.77	0.71	0.82
2	0.55	0.42	0.64	0.74	0.51	0.83
3	0.50	0.33	0.60	0.71	0.53	0.86
4	0.49	0.33	0.56	0.69	0.51	0.83
5	0.54	0.43	0.61	0.76	0.51	0.83
6	0.49	0.42	0.56	0.72	0.62	0.79
7	0.49	0.37	0.61	0.66	0.53	0.82
8	0.48	0.26	0.60	0.68	0.25	0.86
9	0.44	0.26	0.59	0.66	0.25	0.81
10	0.50	0.34	0.63	0.69	0.51	0.82
11	0.47	0.34	0.61	0.70	0.62	0.81
12	0.48	0.30	0.62	0.64	0.32	0.83
13	0.50	0.30	0.64	0.64	0.32	0.83

Fig. 7 Graphe de hauteurs et de DHP pour les 13 sites d'études dans la forêt des Mikea.



La dissimilarité dans l'environnement est également corrélée avec la dissimilarité dans la latitude pour les variables suivantes : Limon, K_2O, P_2O_5, et MgO. Certains ont été sensiblement corrélés avec la longitude. Cependant, il peut y avoir des variables non mesurées qui sont associées à la longitude.



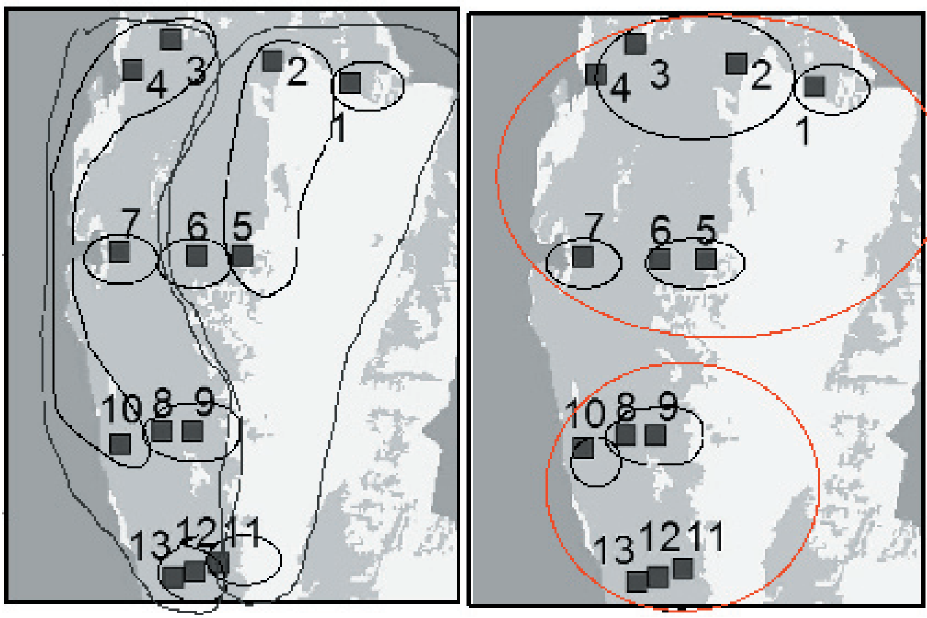
Puisque des variables environnementales sont souvent corrélées avec l'un ou l'autre (latitude et longitude), il a fallu factoriser hors de toutes autres variables environnementales aussi bien la latitude que la longitude pour déterminer la force de la corrélation avec la dissimilarité des espèces. La dissimilarité dans les espèces basées sur P\A était seulement associé à la présence de l'azote (N), dissimilarité basée sur IVI

a été corrélée seulement avec C-N.

Similarité et Dissimilarité au niveau de la composition spécifique et la distance entre les sites

Nos données prouvent qu'il y a des différences dans l'environnement entre les sites. Cependant, même sans différences dans les facteurs environnementaux, les compositions spécifiques peuvent être différent entre les sites dus à leur distance géographique, la séparation et l'histoire. En fait, les test de Mantel montrent que la dissimilarité dans la composition spécifiques entre les sites est sensiblement corrélée avec la distance même en dehors des différences dans l'environnement factorisé.
La similarité en composition spécifique entre les sites basés sur P\A étaient généralement inférieure à celle basée sur les IVI. Ce qui est logique puisque IVI prend en compte les différences sur l'abondance et la fréquence en considération en plus de la présence d'espèces, et ceux-ci changeront habituellement entre les sites. La distance de la parcelle contre la similarité montre cette tendance. Un résultat inattendu de cette étude est que la tendance est beaucoup plus forte pour la similarité basée sur P\A contre IVI, encore, ceci revient aux espèces rares contre la similitude composition de la communauté. Cependant, il y avait des cas ou la comparaison individuelle étaient plus faible en utilisant P\A. et il difficile de faire des comparaisons à d'autres études, mais d'en parler ce ceci semble vraiment hétérogène.

Fig. 8 Cartes montrant les différents groupes suivant les données analysées : A droite analyse utilisant données de la présence et absence on note et à gauche utilisant l'IVI. Ces deux figures montrent la différence en composition floristique(nord sud) et structure (est ouest).



a. Paramètre floristique

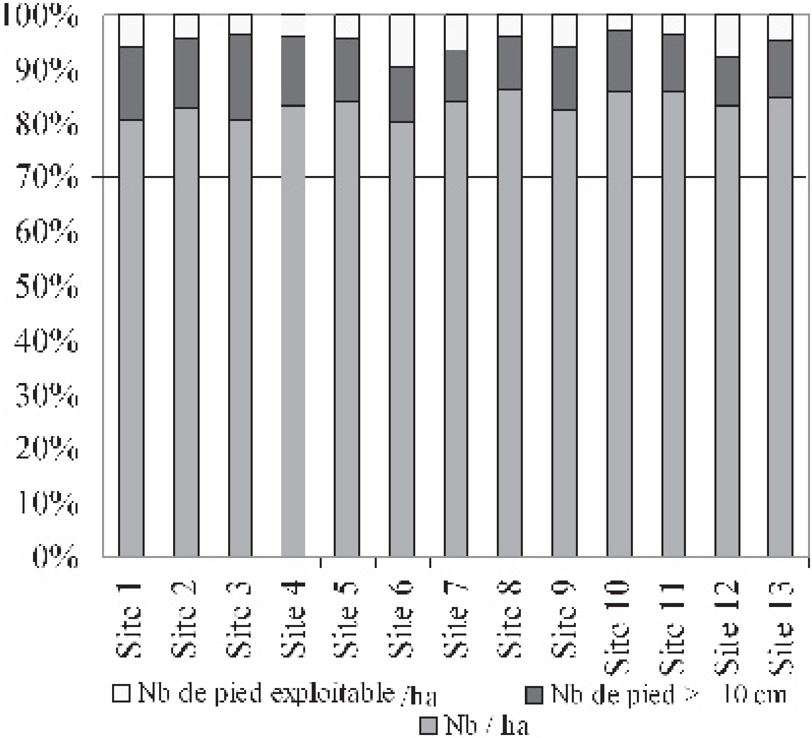
Diversité: Au total 69 familles, 166 genres reparties en 283 morphoespèces ont été recensées lors de cette étude (tableau 2). Soixante dix sur les 283 (27%) recensées se rencontrent seulement dans un seul sites et seulement 6 espèces (0.02%) se rencontrent dans tous les sites. La famille des Fabaceae et des Euphorbiaceae sont les mieux représentées avec 25 morphoespèces suivi par les Burseraceae avec 12 morphoespèces.
Les résultats obtenus montrent que plus de 70 des 283 espèces recensées dans cette étude se rencontre seulement dans un des 13 sites et seulement 6 espèces se rencontrent dans tous le sites (fig. 3 et 4) montrant ainsi l'importance et la particularité de chaque habitat étudié. Parmi les 70 espèces rencontrées dans un seul site, 10 sont indéterminées et 6 sont avec des déterminations « douteuses ». Si on groupe les sites, 27% des espèces recensées sont rencontrées seulement dans un des 13 sites et 8% des espèces se rencontrent entre 10 et 13 sites. Ainsi, chaque site étudié renferme un composition spécifique propre (fig. 3 et 4).

En utilisant aussi bien les données qualitatives (présence/absence, indice de Jaccard) que quantitatives (indice de Shannon), il y a une faible similarité entre les différentes sites (tableau 4, 5 et 8). A 40% de similarité, les sites sont groupés en trois formation : groupe de site 2 et 3 qui représente la formation de transition dans la région nord. Le groupe du site 4, 7 et 10 qui représentent la le haut fourré de la zone côtière. Et enfin le groupe du site 8, 9 12 et 13 représentent la formation de transition entre les 2 première formations. Il y a aussi le groupe du site 6 et 11 qui représente la forêt dense sèche de l'ouest. Le site 1 et 5 fait partie de cette dernier groupe. Il diffère par la présence des trois espèces d'*Adansonia* (*A. grandidieri*, *A. za* et *A. rubrostipa*) cette dernière espèces peut être représentée par un sous espèce qui est différente de celle qui se trouve plus a sud et le long de la formation a *Didierea madagascariensis* sur sable beige et clair.

b. Paramètre structurale

Structure: Les courbes des distributions des hauteurs montrent que les types de formations rencontrés dans la forêt des Mikea varient de la forêt dense sèche (à une hauteur moyenne de 15 à 17 m) à un fourré (haut fourré entre 8–12m et de bas fourré <8m). Selon la formation, le canopée se trouve entre 12 et 15m (sites 3, 4, 5, 10 et 13) et entre 15 et 17 m pour le reste. Le premier groupe reflète la structure d'un haut fourré ou d'une formation de passage entre la forêt dense sèche de l'ouest et le fourré littorale et le deuxième est conforme à une forêt dense sèche de l'ouest. Pour les formation forestière les arbres et arbustes sont groupés au-dessus de ces valeurs et pour les fourré en dessous. A part les sites 3, 5 et 11 ont peut rencontrer des dhp qui dépassent 32.5cm (limite maximum pris arbitrairement) et représenté par de nombreuse espèces en forme de bouteille ou de cigare.

Fig. 9 Graphe montrant la capacité d'exploitation de la forêt des Mikea

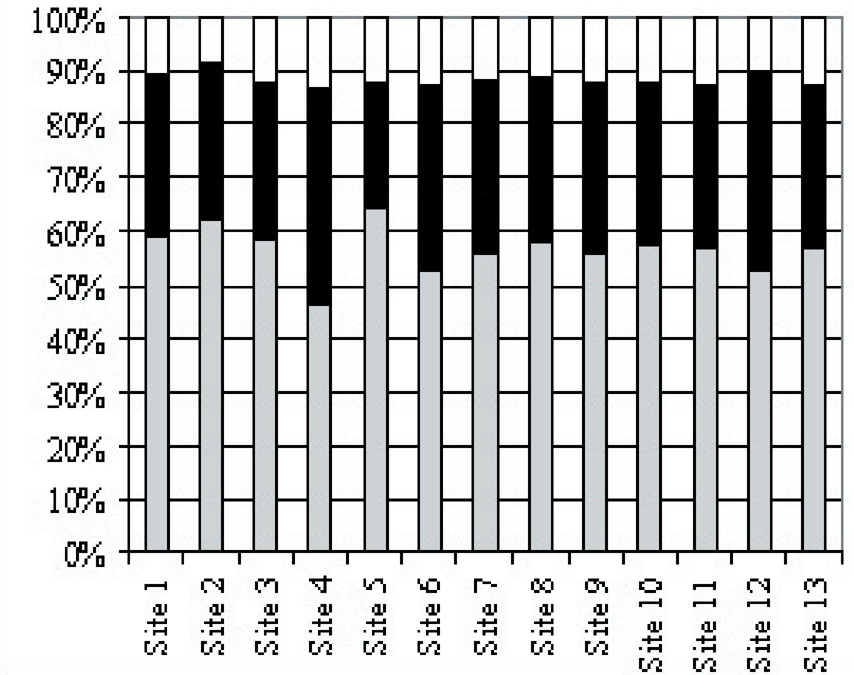


Ainsi, les différentes analyses reflètent les différents aspects de la végétation qui sont importants pour la conservation. Grouper des parcelles basées sur la présence \ absence nous laisse visualiser des groupes basés seulement sur la composition en espèces et donc ces groupements nous aideront à orienter nos objectifs sur la représentation et de cibler les espèces rares. Les groupes basés sur IVI dépeignent une communauté plus générale, qui peut nous permettre d'adresser les buts de conservation qui visent les écosystème végétale et d'habitat ainsi que les fonction écologiques

Discussion

La forêt des Mikea, s'étend sur 30-40km de large et 200km de long en moyenne et se trouve entre une altitude de 0-200m. Selon les auteurs, la forêt des Mikea est placée dans différents Domaines phytogéographique. La carte proposée pour «les écorégion terrestres pour le Réseau National des Aires Protégées» (Plan GRAP 2001) se rapproche des résultats de notre analyses. En effet, selon cette carte, la forêt des Mikea se trouve à cheval dans deux Domaines phytogéographiques: Domaine de l'ouest dominé par la forêt dense sèche (Koechlin *et al*. 1974; White 1993; Lowry *et al.* 1997) et le Domaine du sud dominé par une seule formation: fourré a Didiereaceae et à *Euphorbia* sp. De nombreux auteurs, ont essayé d'éclaircir le problème de passage entre la FDS et le Fourré.

Fig. 10 Graphe montrant la proportion des espèces exploitables par rapport à la totalité des espèces existantes et leurs capacité vis à vis d'un eventuelle exploitation.



Dans sa classification, basée sur la carte de Cornet (1974), Schatz (2000), avait englobé toute la forêt des Mikea dans le bioclimat sub-aride. Pour Humbert et Cours Darnes (1965) une grande partie du nord ouest de la zone est mise avec le domaine de l'Ouest. Koechlin *et al.* (1974) incluent la partie orientale dans le Domaine de l'ouest, dans la Forêt dense sèche de l'ouest, série à *Dalbergia*, *Commiphora* et *Hildegardia*. Tandis que la partie occidentale a été mis dans le Domaine du Sud, végétation appartenant formation : un fourré à Didiereaceae et *Euphorbia* sp (Koechlin *et al*. 1974). Comme le passage de la tropophile de nord-est à celle du sud ouest est très progressif (Koechlin *et al*. 1974), il est difficile de séparer les deux formations à certains endroits. Ce qui nous a amené à adopter le terme de formation de transition qui se trouve entre les deux «végétation climacique».

Razanaka (1995), tentait de donner une aperçu sur la délimitation entre les deux domaines (aires semi-aride et sub-aride). Dans son étude pour la compréhension des limites des aires semi-arides et sub-arides de cette zone, il a reconnu en plus de ces formations principales une transition pour ses transects au niveau de la forêt des Mikea (piste d'Ampasikibo à d'Analabo, au sud de Salary) .

Koechlin *et al*. (1974) «…il n'y a pas de limites nettes entre la forêt caducifoliée de l'ouest et le fourré du sud. Le passage est très progressif et la répartition des deux formations dépend pour une grande part de l'édaphisme: En effet en fonction des

conditions stationnelles particulières, des îlots du sud peuvent se retrouver inclus en plein Domaine de l'ouest d'une part, la forêt caducifoliée de l'ouest arrive à pénétrer largement le domaine du Sud d'autre part, du moins tel qu'il est défini par H. Humbert».

Dans notre étude, les sites suivants : (site 1, site 2, site 6, site 8, site 9, site 11 et site 12) répondent plus à la définition d'une forêt dense sèche que d'un fourré aussi du point de vue physionomie: strate dominante de 8 à 10 et pouvant atteindre 20m (Humbert & Cours Darnes 1965; Koechlin *et al.* 1974; White 1983; Lowry *et al*. 2000). La formation du site qui est dominé par les 3 espèces d'*Adansonia* (*A. grandidieri*, *A. za* et *A. rubrostipa*) association qui se rencontre dans la région de Moronadava confirme la continuité de cette formation au deçà du Fleuve Mangoky.

Les sites 3 site 4, site 10 et site 13 correspond à la définition de haute fourré qui est même définit par Koechlin *et al*. (1974) comme étant une véritable forêt.

Ces classification avancées sont vérifiées par la présence des espèces caractéristiques de ces formations. Des espèces indicatrice comme le *Didierea madagascariensis* (Didiereaceae) apparaît au fur et à mesure que l'on avance vers l'ouest montre par la densité croissante de cette dernière, montre le passage progressive d'une formation à une autre.

Les courbes des distributions des dhp montrent que la majorité des espèces ont des dhp inférieurs à 15 cm même dans les forêts denses sèches. Ce qui explique en même temps une exploitation intensive mais aussi un forme de transition vers les fourré.

Il n'est plus a rappeler que la flore de Madagascar a toujours fasciné les spécialistes depuis la nuit des temps. Schatz (2000) a avancé que pour la région sèche, 55% des genres sont endémique et 29 % pour la région semi-aride, et que 8.1% ont une distribution limité pour une seule région.

Parmi les 8 familles endémique de Madagascar cité par Schatz *et al* (2000), 2 sont recensées dans les sites étudiés: Sphaerosepalaceae (2/18) et Didiereaceae (4/11). Une troisième famille est rencontrée en dehors des ces sites: Physenaceae (1/2). La famille des Didiereaceae est une famille «endemique du sud» (du Domaine) (Applequist et Wallace 2000). Ces chiffres justifient le taux élevé de l'endémicité de la flore du sud. Aussi, seulement 2 genres des formations sub-aride avancées par Schatz (2000) sont recensés: *Alluaudiopis marnierana* (1/2), *Didierea madagascariensis* (1/2) dans la zone.

Sur les 6 espèces d'*Adansonia* rencontrées à Madagascar, 3 sont recensées dans la zone d'étude: *Adansonia grandidieri, A. za* et *A. rubrostipa*, ou une espèces, *A. grandidieri* est confiée aux alentours du lac Ihotry et avec un îlot isolé à quelques km au Sud de Morombe. Cette espèce est liée à la présence de nappe phréatique.

La végétation du sud et du sud-ouest est loin d'être comparable à d'autre formation avoisinante bien que l'architecture de quelques espèces rappellent les espèces africaines ou sud américain. Applequist & Wallace (2000) ont fait une étude phylogénétique de cette famille pour voir son affinité avec la famille de Portulacaceae pour voir ainsi l'évolution de la flore de Madagascar et en particulier du sud et du sud-est.

CONCLUSION

L'hypothèse de l'existence de la variation nord-sud et est-ouest a été bien vérifier par différents méthode d'analyse et de test. La variation affecte plus la composition floristique suivant le gradient nord sud tandis que le gradient est ouest touche plus les structures (fig. 7). Ces résultats confirment l'existence de différents type d'habitat et de formation végétale. Mais ces résultats ne sont pas encore suffisantes pour confirmer la représentativité de l'aire prioritaire délimité au début de l'étude.

Ainsi la conservation de la forêt des Mikea doit prendre en considération non seulement de la variation latitudinale mais aussi suivant le gradient longitudinale. Cependant des complément de recherche et d'information sont nécessaire pour compléter les analyse et aussi de comprendre cette variation.

Ainsi, les différentes analyses faites reflète les différents aspects de la végétation qui sont importants pour la conservation. Les analyse au niveau de la composition spécifique i.e. présence\absence nous laisse visualiser une variation nord sud et l'utilisation des données quantitatifs nous donne des variation est Ouest. les groupes basés seulement sur la composition en espèces et donc ces groupements nous aideront à orienter nos objectifs sur la représentation et de cibler les espèces rares. Les groupes basés sur IVI dépeignent une communauté plus générale, qui peut nous permettre d'adresser les buts de conservation qui visent les écosystème végétale et d'habitat ainsi que les fonction écologiques.

RECOMMANDATIONS

Bien que les sites d'études ont été choisis selon une carte d'habitat supposée recouvrir toute la zone, pendant l'inventaire et l'analyse, nous avons constaté que certains habitats ont été omis comme la zone côtière. De plus après les analyses, nous proposons de continuer l'inventaires.

Les résultats obtenus démontrent l'hétérogénéité de la forêt des Mikea et montrent que la totalité de la zone ou il reste encore de forêt intacte, aussi bien du nord au sud que d'est en ouest, sont requiert comme un noyau pour une conservation .
Ainsi, la totalité de l'aire délimité par WWF comme aire prioritaire pour une action de conservation, sont inclus dans cette zone.

Du point de vue exploitation, les graphes 6 et graphe 7 montrent qu'il faut faire attention aux types d'activités à prévoir pour les transferts de gestion dans la région car : chaque type décrit est unique et que le pourcentage d'espèce et de pied est très faible qui pourra entraîner une perturbation et voire même perte de certaines espèces.

Les courbes des distributions des dhp montrent que la majorité des espèces ont des dhp inférieurs a 15cm même dans les FDS. Ce qui explique en même temps une exploitation intensive mais aussi un forme de transition vers les fourré.

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A new species of *Morellia* Robineau-Desvoidy, 1830 from the Seychelles Islands (Insecta, Diptera: Muscidae)

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Abstract. - A new species, *Morellia insularis* sp. nov., is described. It is a member of the family Muscidae and is endemic to the Seychelles Islands.

Keywords. - Diptera, Muscidae, Morellia, Seychelles, new species, check list

Introduction

Our knowledge of the muscid fauna of the Seychelles is largely based on the report by Stein (1910) on material collected by the Percy Sladen expedition. Stein listed 17 species which are assigned to the Muscidae as currently defined (plus 1 Anthomyiidae and 1 Fanniidae). Bezzi (1923) discussed Stein's list, updated some of the nomenclature, and added one further species. Since then four further species have been recorded from the Seychelles so that the total number of known species, including the one described below, is now 23.

The Seychelles Muscidae include five endemic species (*Myospila compressipalpis* (Stein. 1910), *Helina mediana* (Stein, 1910), *Dichaetomyia fasciculifera* (Stein, 1910), *Atherigona maculipennis* (Stein, 1910), and *Atherigona basitarsalis* Deeming, 1987) (see Pont 1980). The remaining 16 are found elsewhere in the Malagasy subregion or are widespread Afrotropical, Palaeotropical or Pantropical species.

This paper reports on a new, endemic species of the genus *Morellia* Robineau-Desvoidy, 1830. This genus contains some 60 species, and has representatives in all zoogeographic regions. It is most speciose in the Afrotropical, Oriental and Neotropical regions. So far as is known, all the species breed in the dung of ungulates, especially of cattle, and the larvae are coprophagous (Skidmore 1985). The adults of many species are sweat flies.

Materials and Methods

The following abbreviations are used for the museums where the type-series of the new species is deposited:

BMNH	The Natural History Museum, London, U.K.
MNHNP	Muséum National d'Histoire Naturelle, Paris, France.
NMP	Natal Museum, Pietermaritzburg, South Africa.

MM = male
FF = female

Morellia insularis sp. nov.
Figs 1-2

Holotype

MM, SEYCHELLES: Praslin, G'Anse, 30.v.1906 (P.R.Dupont), BMNH.

Paratypes

13MM 17FF, SEYCHELLES: data as for holotype, 4FF, BMNH; Praslin, 29.v.1906 (P.R.Dupont), 1MM, BMNH; Mahé, 11.xi.1977 (J.David & L.Tsacas), 1MM, MNHNP; Mahé, La Mare aux Cochons, 7.xi.1977 (J.David & L.Tsacas), 2MM, MNHNP; Mahé, La Mare aux Cochons, 14.xi.1977 (J.David & L.Tsacas), 1MM 1FF, MNHNP; Mahé, Cascade, 10.iii.1965 (Tams & Nye), 2FF, BMNH; Mahé, Beau Vallon, 20.ii.1965 (Tams & Nye), 2MM 1FF, BMNH; Mahé, Beau Vallon, 24.iii.1965 (Tams & Nye), 1MM 1FF, NMP, and 2MM 6FF, BMNH; Mahé, Beau Vallon, 26-27.iii.1965 (Tams & Nye), 2MM 1FF, BMNH; Mahé, Beau Vallon, 9.iv.1965 (Tams & Nye), 1MM 1FF, BMNH.

Description

MM. *Head*. Ground-colour black. Frons at narrowest point slightly broader than diameter of anterior ocellus. Eyes virtually bare, with only the usual microscopic pubescence; upper inner facets enlarged as usual but not strikingly so. Fronto-orbital plates silvery-white pruinose on lower third, brownish above this and subshining at vertex; parafacial silvery-white, genae and lower occiput light grey. Fronto-orbital plates very narrow, at lunula a plate not quite half width of antennal flagellomere. Frontal vitta linear, visible on half of frons only as a seam where the fronto-orbital plates touch. 12-15 pairs of moderate frontal setae, extending from lunula to anterior ocellus, those on upper two-thirds proclinate, only those on lower third inclinate; orbitals absent. Antennae black, flagellomere 2.5 times as long as broad; arista long-plumose, the longest combined plumosity equal to length of antennal flagellomere. Parafacial slender, at middle not quite half width of antennal flagellomere, hardly narrowed below. Vibrissal angle below level of profrons. Setulae on facial ridges ascending half the distance from vibrissa to base of antennal flagellomere. Gena moderate, the depth below lowest eye-margin equal to width of antennal flagellomere. Peristomal setae short but quite dense; beard black. Proboscis not elongated, prementum thinly dusted; palpi dark brown, slim. - *Thorax*. Ground-colour

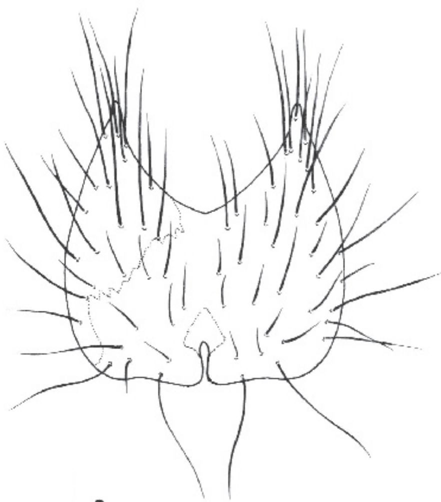
black, spiracles dark brown. Scutum with light grey dust, tinged with yellow behind, as follows: a median vitta beginning at neck and occupying the acrostichal space, narrowed slightly behind suture, broadening before scutellum to cover the prescutellar dorsocentral setae; a broad patch over postpronotal lobes and notopleura; a small postsutural vitta between intra-alar and supra-alar setae; the scutum thus appearing to have two broad black vittae from neck to scutellum. Pleura thinly light grey dusted. Scutellum in posterior view undusted except on ventral edge from base almost to apex and on a pair of lateral patches between sub-basal lateral and subapical discal setae. Ground-setulae quite short and dense on scutum. Acrostichals 0+1. Dorsocentrals 2+5, the presutural and anterior two postsutural pairs short and fine. 1 postsutural intra-alar. Prealar short, less than half length of 2nd notopleural seta. Prosternum and proepisternal depression bare. Anepisternum usually with a fine setula in upper anterior corner. Notopleuron with only a few setulae at the base of the setae, these sometimes absent. Katepisternals 1+2. Greater ampulla bare. Meron usually with 1-3 setulae on beret (katepimeron), rarely bare, haired below spiracle and on metakatepisternum, rarely bare. Posterior spiracle with a few setae on posterior margin. Katatergite and anatergite bare. Scutellum setulose all over disc and lateral margins, and at ventral angle of lateral margins with fine setulose hairs. With strong sub-basal lateral, subapical discal and apical setae. - *Legs*. Black. Without striking modifications. Fore femur without anteroventral setae, with a complete posteroventral row. Fore tibia in apical half with erect setulae on posterior to posteroventral surfaces, and 3-4 posteroventral setae. Mid femur normal in shape, without preapical notches or tubercles; anteroventral surface with several short setae in basal two-fifths, and posteroventral surface with a row of moderate setae from base to just beyond middle; a strong anterior seta at middle; 0 anterior and 3 posterodorsal to posterior preapical setae. Mid tibia without basal notches or tubercles, and without erect anterior setulae; without setae except for 4-5 posterior setae. Hind femur with a few short posteroventral setae in basal third; with a complete anteroventral row, the setae short in basal half. Hind tibia with a strong calcar, without further setae on this surface; anterodorsal surface with a row of short setae, 2-3 of them stronger; without posteroventrals; 3-4 short anteroventral setae; dorsal apical seta present and longer than tibial depth, an anterodorsal and a posterodorsal apical also present, shorter than the dorsal. - *Wing*. Brownish costally and basally, otherwise without markings; veins yellow. Basicosta and tegula dark brown. Wing-membrane entirely covered with microtrichia, without any bare patches. Stem-vein with a few short setulae in basal part, before humeral cross-vein, on upper and lower surfaces, those on upper surface sometimes absent. Vein R1 bare. Vein R4+5 with a few setulae at base on upper and lower surfaces, not extending as far as cross-vein r-m. Vein M curved foward towards vein R4+5 in apical part, cell r4+5 at wing-tip slightly shorter than cross-vein r-m. Lower calypter brownish, with white margin and fringe, upper calypter white. Halteres yellow. - *Abdomen*. Ground-colour black. Tergites covered with rather dense grey dust, without any shifting chequered patches, in dorsal and posterior views with the following areas black and undusted: all of syntergite 1+2; a median vitta and a hind-marginal band on tergites 3-5, these both narrow on tergite 5. Sides of tergites 3-5 dusted, except on hind-margins, and sternites 2-5 dusted except around edges. Tergites without any striking setae. Sternite 1 setulose. - *Genitalia*. Sternite 5 (Fig. 1) with a rather pointed projection at the tip of each lobe. Cercal plate (Fig. 2) with

the apex simple, rounded. - *Measurements*. Length of body, 4.5 - 6.0 mm. Length of wing, 4.0 - 5.5 mm.

FF. Differs from the MM as follows. *Head*. Frons broad but at middle much less than an eye-width; frons parallel-sided, only broadening just before lunula. Fronto-orbital plates subshining black on upper two-thirds, silvery-white pruinose on lower third; parafacial, gena and lower occiput also silvery-white pruinose. Frontal vitta matt black, frontal triangle subshining and reaching halfway from anterior ocellus to lunula. Inner vertical seta long and strong, outer vertical hardly distint from the adjacent post-ocular setulae. Fronto-orbital plates broadening slightly from vertex to lunula, and frontal vitta consequently narrowing; at middle a fronto-orbital plate one-third width of frontal vitta. 9-10 pairs of inclinate frontal setae, with a few interstitials; 2 pairs of short reclinate and 2 pairs of well-developed proclinate orbital setae; fronto-orbital plates with only a few setulae outside the setae. Frontal vitta bare. Parafacial slightly broader. - *Thorax*. The median dusted vitta very constricted behind suture, actually or almost separated from the prescutellar patch. Presutural and anterior postsutural dorsocentrals shorter and finer. - *Legs*. Fore tibia without any posterior or posteroventral setae. Mid femur with the anteroventral and posteroventral setae shorter, the posteroventrals virtually absent. Hind tibia with the anterodorsal row setulose, with 1-2 setae. - *Wings*. Vein R4+5 with the setulae usually reaching to cross-vein r-m but at most only 1 setula beyond this point. Lower calypter yellowish, sometimes rather dirty outside. - *Abdomen*. Dusting yellowish-grey, with some shifting chequered patches on tergites 4 and 5. - *Ovipositor*. Not examined. - *Measurements*. Length of body, 4.0 - 5.5 mm. Length of wing, 3.5 - 5.0 mm.

Several of the TAMS & NYE specimens appear to be freshly emerged: they are not fully hardened, the heads are rather shrunken, and the legs are twisted.

1



2

Figs. 1-2. *Morellia insularis* sp.nov. (Praslin, 29.v.1906) - 1: MM sternite 5. - 2: MM cercal plate.

Etymology

The species name is formed from the Latin word "insula", meaning "island", and refers to the geographic isolation of the species.

Differential diagnosis

This species does not agree with any of the described Afrotropical and Oriental species of *Morellia*, and can be recognised by the following combination of characters: prosternum bare; presutural dorsocentral setae short but distinct; discal cell of wing completely haired; MM fore tibia with 2-3 short fine posteroventral setae, mid tibia simple, hind tibia with short anteroventral setae; FF fore tibia without a posterior seta. The MM cercal plate (Fig. 2) is quite unlike that of any of the known Afrotropical species as illustrated by ZIELKE (1971: fig. 10).

ACKNOWLEDGEMENTS

I am grateful to Nigel Wyatt (BMNH) and Christophe Daugeron (MNHNP) for the loan of the material discussed in this paper.

APPENDIX: CHECK LIST OF SEYCHELLES MUSCIDAE

I append below a list of the species of Muscidae now known from the Seychelles, together with a general comment on their distribution. The genera are listed alphabetically, and the species alphabetically within each genus.

Alluaudinella bivittata (MACQUART, 1843)
(GIGLIO-TOS, 1896: 363; STEIN, 1910: 151) Afrotropical, including Malagasy subregion

Atherigona basitarsalis DEEMING, 1987
(DEEMING, 1987: 22) Seychelles, endemic

Atherigona bimaculata STEIN, 1910
(STEIN, 1910: 157) Afrotropical, including Malagasy subregion

Atherigona laevigata (LOEW, 1852)
(STEIN, 1910: 158, as *scutellaris* STEIN) Afrotropical, including Malagasy subregion

Atherigona maculipennis (STEIN, 1910)
(STEIN, 1910: 158) Seychelles, endemic

Atherigona orientalis SCHINER, 1868
(STEIN, 1910: 159, as *trilineata* STEIN) Pantropical (Old and New World)

Coenosia exigua STEIN, 1910
(STEIN, 1910: 161) Palaeotropical

Dichaetomyia fasciculifera (STEIN, 1910)
(STEIN, 1910: 153) Seychelles, endemic

Haematobia exigua DE MEIJERE, 1903
(PONT, 1980: 759) Oriental-Australasian

Helina mediana (STEIN, 1910)
(STEIN, 1910: 152) Seychelles, endemic
Hydrotaea chalcogaster (WIEDEMANN, 1824)
(STEIN, 1910: 155) Pantropical
Hydrotaea nigrisquama (STEIN, 1910)
(STEIN, 1910: 154) Malagasy subregion
Limnophora fasciolata STEIN, 1910
(STEIN, 1910: 155) Malagasy subregion
Morellia insularis sp.nov.
Seychelles, endemic
Musca confiscata SPEISER, 1924
(STEIN, 1910: 149, as *fasciata* STEIN, preocc.) Palaeotropical
Musca domestica LINNAEUS, 1758
(GIGLIO-TOS, 1895: 362) Cosmopolitan
Musca sorbens WIEDEMANN, 1830
(STEIN, 1910: 149. as *niveisquama* THOMSON) Palaeotropical
Myospila compressipalpis (STEIN, 1910)
(STEIN, 1910: 151) Seychelles, endemic
Pygophora pallipalpis (STEIN, 1910)
(STEIN, 1910: 160) Malagasy subregion
Pygophora respondens (WALKER, 1859)
(STEIN, 1910: 162, as *lobata* STEIN) Palaeotropical
Stomoxys calcitrans (LINNAEUS, 1758)
(JAMES, 1947: 133) Cosmopolitan
Stomoxys niger MACQUART, 1851
(STEIN, 1910: 150, as *glauca* GRÜNBERG) Afrotropical, including Malagasy subregion
Synthesiomyia nudiseta (WULP, 1883)
(BEZZI, 1923: 81) Pantropical (Old and New World)

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Phelsuma **14**; 44-54

New Porricondylinae gall midges (Diptera: Cecidomyiidae) from the Seychelles archipelago

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Abstract - 25 species of Cecidomyiidae gall midges have been described from the Seychelles archipelago, all require revision. New material is reported here, with the first reporting of the presence of the subfamily Porriconcylinae from the islands. A new species *Asinapta northi* sp. n. is described.

Key words - Seychelles archipelago, Cecidomyiidae, fauna, new species.

Introduction

Limited collection of gall midges has been done in the Seychelles archipelago islands. H. Scott collected some free-living gall midges from islands Silhouette and Mahé and Anonyme island. J.J.Kieffer (1911) identified the material and described all taxa as new species: 24 new species and 4 new genera – *Chrysodiplosis*, *Lepidodiplosis*, *Planodiplosis*, and *Prowinnertzia*. Later Kieffer (1912, 1913a) revised these descriptions and established eight new genera based on species recorded from the Seychelles islands – *Clinophaena*, *Lasiodiplosis*, *Lepidobremia*, *Nanodiplosis*, *Plagiodiplosis*, *Properrisia*, *Nanolauthia*, and *Sphaerolauthia*. Genera and species were only partly revised afterwards and many uncertainties over their status remain. H.F. Barnes (1939) described new genus and species *Megommata seychelli*, based on material collected by on Dennis Island, preying on the coccid *Pulvinaria* sp. associated with coffee trees.

K.M. Harris (1980) issued the Catalogue of the Diptera of the Afrotropical Region and mentioned 25 species from the Seychelles. Finally, R.J. Gagné (2004) listed all species known from the Seychelles in the catalogue of the World Cecidomyiidae taking into account the latest advances in taxonomy of gall midges.

In addition to the 25 species currently recorded from Seychelles some of the numerous species described from East Africa by J.J. Kieffer (1913b) may be found also in Seychelles after more thorough research there. Similarly, the new genus and nine new species of Porricondylinae described from Somalia (Mamaev & Zaitzev 1997) may also occur in the archipelago. The present paper reports on recent collections from granitic and coral islands of the Seychelles group.

Methods

Gall midges were collected on D'Arros Island (15-17.09.2003, mixed forest, Malaise trap, leg. J.Gerlach), Denis Island (20-23.06.2003, open *Pisonia grandis*/ *Casuarina equisetifolia* woodland, Malaise trap, leg. J.Gerlach), and North Island (30.07-15.08.2005, marsh edge, Malaise trap, leg. O'Shea); Picard Island, Aldabra (22-29.09.2005, mixed scrub at sea level, Malaise trap, leg. O.Maurel & K.Mach). Gall midges were dehydrated and mounted in Canada balsam on microscopic slides. Slides with gall midges are deposited in the Natural History Museum, London (BMNH).

Results

In total 234 individuals were collected during survey (Table 1). These are dominated by the Cecidomyiinae, which is the most diverse subfamily of gall midges, but currently cannot be identified. The Lestremiinae comprise only a small number of individuals which need to be analysed as part of a global revision. Porricondylinae are considered further here.

There has been little study of the subfamily Porricondylinae in the Afrotropical region and undescribed species are definitely present. The genera *Winnertzia* and *Camptomyia* are represented by females only and cannot be identified to species. There are two undescribed species; a species of *Asinapta* described as a new species below and a species of Dicerurini, which cannot be fully described due to the poor condition of the single specimen.

Descriptions of new taxa

Asinapta northi sp. n.

Fig. 1A, B.

Holotype: male on microscopic slide labelled as "No. S1, Seychelles, North Island, 30.07-15.08.2005, marsh edge, Malaise trap, leg. O'Shea". **Paratypes**: 4 males on microscopic slides No. S2, S3, S4, S5 labelled as for holotype; 2 females on microscopic slides No. S6, S7 labelled as for holotype. Type specimens deposited in the BMNH.

Table 1. Summary of gall midges collected in Seychelles in 2003-5

Taxon	Island and collection date			
	D'Arros 21.vi.2003.	Denis 16.vii.2003.	North 30.vii-15.viii.2005	Picard 22-29.ix.2005
Lestremiinae	2	8	6	-
Cecidomyiinae	35	28	123	7
Porricondylinae, total	7	-	17	1
Asinapta northi sp. n.	-	-	16	-
Dicerurini sp.	-	-	-	1
Winnertzia sp.	1	-	1	-
Camptomyia sp.	6	-	-	-

Male. Yellowish in colour, antennae slightly darker, thorax patchy with distinct darker dorsal stripes. Length of body 1.4-1.8 mm, length of wing 1.2-1.7 mm. Head round, eyes almost completely covering head. Antenna with 2+14-19 flagellomeres, scape with ventral widening and few setae, pedicel subcylindrical with 1 medial and 4 lateral setae, medial flagellomeres with oval node 1.1-1.3 times longer than width, stem 0.7-0.8 length node, terminal segment conical with short cylindrical projection, terminal two segments may be fused. Basal whorl of setae with about 20, medial – about 40, distal whorl – about 10 setae. Ring-shaped sensoria simple, wide, present on all flagellomeres. Palpi with 4 segments, longer than height of head, segments with relative length as 1:3:5:6 respectively. Eyes large, eye bridge 10-11 ommatidia wide. Thorax with numerous mesopleural and pteropleural seta. Halteres 2 times shorter than height of thorax. Wings wide, 2 times longer than width, Rm-m and Rs forming narrow angle with R_5, R_1 joins C before middle of wing, R_5 evenly bent and joining with C at wing apex, M_{1+2} indistinct, M_{3+4} distinct, nearly straight, evanescent at apex, Cu simple, evenly bent in distal part, evanescent at apex, joining with hind margin at narrow angle. Hind half of tergites swollen and covered with longer setae, sternites without distinct pattern. Legs relatively short, femur, tibia, $tarsus_2$ nearly the same length, $tarsomeres_1$ with pointed apical projection, tarsomeres with relative length as 1:8:4:2:1 respectively. Tarsal claws dark, with long basal teeth. Empodium as long as claws.

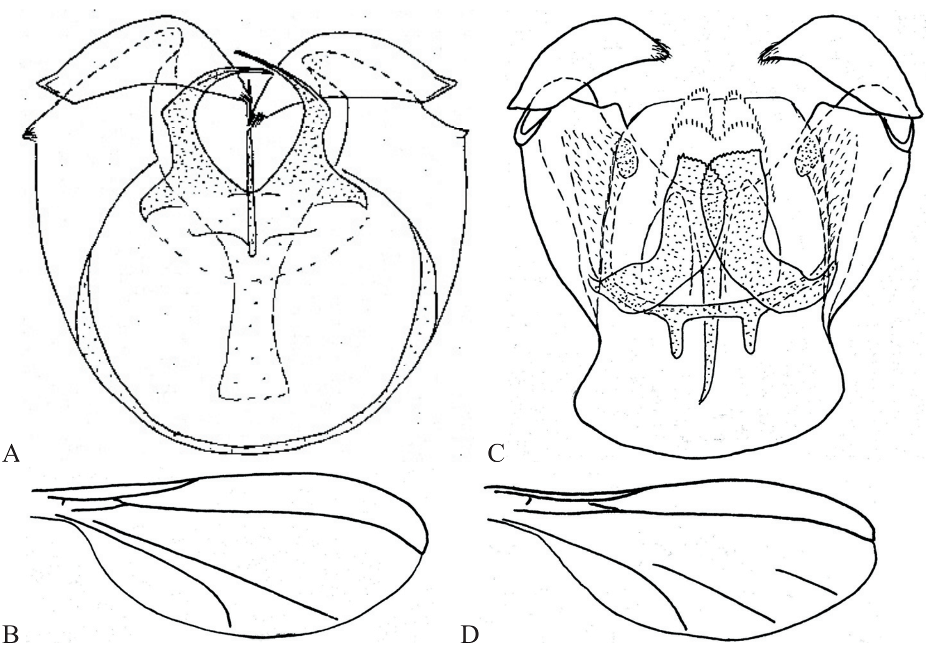

Figure 1. Hypopygium and wing: A and B - *Asinapta northi* sp. n., holotype; C and D – Dicerurini sp.

Hypopyge. Gonocoxites massive, widely fused, with setose elongated mediodistal lobe. Ventral plate indistinct. Gonostyles slightly curved, 3.5 times longer than width, moderately inflated at middle length, pointed to apex, with dark, short pectinate claw. Epandrium membranous, weakly distinct. Hypandrium and cerci of nearly equal in size, relatively small, bilobed. Parameres light brown, sclerotised, strongly curved, with lateral tooth and widened base. Genital rod simple, fine, weakly sclerotised. Gonocoxite roots fused, long, weakly sclerotised. Transverse bridge indistinct.
Female. Length of body 1.2-2.0 mm, length of wings 1.1-2.0 mm. Antennae with 2+13-21 segments, flagellomeres with node as long as wide, stem conical, 0.2 length of node. Medial whorl of seta consists of two groups of setae. Sensoria ring-shaped connected with 2 comisures, present on all flagellomeres. Ovipositor telescopic, about half of length of abdomen, terminal lamella elongate-oval. Other characters as in male.
Larva and biology unknown.
Material examined: types and 9 males from the type locality – North Island.
Remarks. New species is similar to *Asinapta mira* described from Somalia (Mamaev & Zaitzev 1997), but clearly differs in morphology of the hypopygium.
Derivation of specific epithet: from the type locality – North Island.

Dicerurini sp.

Fig. 1C, D.

Material examined: male on microscopic slide labelled as "No. S8, Seychelles, Picard Island, Aldabra, 22-29.09.2005, mixed scrub at sea level. Malaise trap, leg. O.Maurel & K.Mach".

Male. Yellowish, thorax brownish in colour. Antennae greyish. Length of body 1.3 mm, length of wings 1.6 mm. Antennae with broken segments, only 3 flagellomeres remained. Scape and pedicel longer than width. Scape with 7-8 setae, pedicel with 3-4 setae. Flagellomeres with cylindrical node 2 times longer than width, stem as long as node. Basal whorl of seta consists of 11-12 setae, medial – of 9-10 setae with enlarged sockets, distal – of 6-8 setae. Ring-shaped sensoria simple. Palpi secondarily (?) with 5 segments, as long as height of head, segments with relative length as 1:1:2:1:1 respectively. Eyes cover nearly all head surface, eye bridge very wide. Thorax with mesopleural and pteropleural seta. Haltere shorter than height of thorax. Wings wide, 2.5 times longer than width, Rm-m and Rs forming narrow angle with R_5, R_1 joins C before middle of wing, R_5 situated close to C and joining with C before wing apex, M_{1+2} distinct in distal part, Cu_1 and Cu_2 independent, Cu_1 weakly distinct at distal part, straight, Cu_2 evenly bent in distal part, evanescent at apex, joining with hind margin at narrow angle. Abdomen with tergites and sternites without distinct pattern. Legs long, fine, tarsomeres with relative length as 1:8:4:2:1 respectively. Tarsal claws with basal teeth. Empodium rudimentary.
Hypopyge. Gonocoxites slender with medial sclerotized, smooth lobe. Ventral plate wide with wide emargination, having indistinct lateral lobes. Gonostyles two times longer

than width, slightly curved and inflated, apex pubescent with no claw. Epandrium wide. Hypandrium large, bilobed, cerci smaller, rounded, bilobed. Parameres extremely wide and flattened, strongly sclerotised, partly overlapping. Genital rod strongly sclerotised, widened to distal part. Transverse bridge well developed, strongly sclerotised with short, strongly sclerotised roots.

Female, larva, biology unknown.

Acknowledgements

I would like to thank to J.Gerlach for providing the material from the Seychelles and to M.Jaschhof for comments on Lestremiinae.

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Theridiid or cobweb spiders of the granitic Seychelles islands (Araneae, Theridiidae)

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Abstract. - This paper describes 8 new genera, namely *Argyrodella* (type species *Argyrodes pusillus* Saaristo, 1978), *Bardala* (type species *Achearanea labarda* Roberts, 1982), *Nanume* (type species *Theridion naneum* Roberts, 1983), *Robertia* (type species *Theridion braueri* (Simon, 1898), *Selimus* (type species *Theridion placens* Blackwall, 1877), *Sesato* (type species *Sesato setosa* n. sp.), *Spinembolia* (type species *Theridion clabnum* Roberts, 1978), and *Stoda* (type species *Theridion libudum* Roberts, 1978) and one new species (*Sesato setosa* n. sp.). The following new combinations are also presented: *Phycosoma spundana* (Roberts, 1978) **n. comb.**, *Argyrodella pusillus* (Saaristo, 1978) **n. comb.,** *Rhomphaea recurvatus* (Saaristo, 1978) **n. comb.**, *Rhomphaea barycephalus* (Roberts, 1983) **n. comb.**, *Bardala labarda* (Roberts, 1982) **n. comb.**, *Moneta coercervus* (Roberts, 1978) **n. comb.**, *Nanume naneum* (Roberts, 1983) **n. comb.**, *Parasteatoda mundula* (L. Koch, 1872) **n. comb.**, *Robertia braueri* (Simon, 1898). **n. comb.**, Selimus *placens* (Blackwall, 1877) **n. comb.**, *Sesato setosa* **n. gen, n. sp.**, *Spinembolia* clabnum (Roberts, 1978) **n. comb.**, and *Stoda libudum* (Roberts, 1978) **n. comb.**. Also the opposite sex of four species are described for the first time, namely females of *Phycosoma spundana* (Roberts, 1978) and *P. menustya* (Roberts, 1983) and males of *Spinembolia clabnum* (Roberts, 1978) and *Stoda libudum* (Roberts, 1978). Finally the morphology and terminology of the male and female secondary genital organs are discussed.

Key words. - copulatory organs, morphology, Seychelles, spiders, Theridiidae.

Introduction

Theridiids or comb-footed spiders are very variable in general apperance often with considerable sexual dimorphism. Size is also variable, from very small to fairly large species. They can usually be recognized by the following characters: 1) legs bearing only a few spines (one to two in patella and tibia I at least); 2) tarsus IV with a row of serrate bristles, the so-called tarsal comb (absent e.g. in *Argyrodes*); 3) colulus usually absent or repleced with two setae (fleshy colulus e.g. in *Argyrodes*); 4) usually no cheliceral teeth (or 1-3 on promargin and rarely 1-3 on retromargin); 5) labium with a seam towards the sternum, never swollen (= rebordered) distally; 6) height of clypeus, at most, equal to the diameter of AMEs. Numerous species a have very conspicous apparatus on the dorsal side of their body for sound production. It is a washboard-like

dorsal stridulatory organ; the picks are formed by small hairs bearing chitinized dents on the anterodorsal part of abdomen while the stridulating files of the posterior part of carapace are formed by transverse rows of thin ridges on both sides of the median line.

The Theridiidae is a large family comprising 86 genera and 2227 species (Platnick 2006). In the granitic Seychelles theridiids are represented by 19 genera and 26 species (Saaristo 1978, Roberts 1978 & 1983, and this paper). In my earlier paper (Saaristo 1978) I already presented some disagreements with the then current use of delimiting theridiid genera based on the listing of valid genera by Levi & Levi (1962) in the same lines as previously used by Archer (1946, 1950). At present the taxonomy of Theridiidae seems to be undergoing considerable modifications on the generic level and numerous genera placed in synonymy by Levi & Levi (1962) have been revalided, especially by Wunderlich (1987, 1995), Okuma (1994), Yoshida (1991, 2001a, b, 2002, 2003) and Agnarsson (2004). Also several new genera have been created. The actions of the above mention authors seems to me to be on correct lines. In this paper some new genera are also created based especially on the information derived from the secondary genital organs.

Material and methods

Specimens were examined under a Leitz stereomicroscope and measured under a Wild M5 stereomicroscope. For examination of genital structures right palps of males were detached from the spider body and placed on a cotton bed in a small bowl filled with 75% alcohol. In a few cases they were cleared by KOH solution to study the inner structures. Female genital organs were mostly studied in situ. Illustrations were made under a Leitz stereomicroscope with a drawing apparatus. Male palps were drawn from left ones. All measurements are in millimeters.

The samples used for this study are kept in arachnological collection of the Zoological Museum, University of Turku, Finland (MZT). Some types and other comparative material were studied in Musée Royal de l'Afrique Centrale, Tervuren, Belgium (MRAC).

Abbrevations

ALI = atrial lingua	ATR = atrium
CHO = cymbial hook	CL = length of carapace
CON = conductor	CPI = cymbial pit
ECO = embolic complex	EHO = entrance holes
EMB = embolus	ETU = entranrace tubes
FTU = fertilizing tubes	SRE = seminal receptaculae
TAP = terminal apophysis	TL = total length
TOR = tarsal organ	

TTA1 = theridiid tegular apophysis containing a loof of seminal duct

TTA2 = theridiid tegular apophysis devoid of seminal duct

# = male	$ = female

Notes on the morphology of the male and female copulatory organs

In Theridiidae there are primarily four different sclerites arising from the tegulum. In my earlier paper (Saaristo 1978) I thoroughly discussed the morphology of the theridiid male palp. I was able to show that in the lateral inner side of the cymbium closeto the tarsal organ on its apical side there are two kinds of special structures, viz. a hook-like extension or alternatively a pit-like depression. The first mentioned structure was already known to Levi (1961) who referred to it as paracymbium. I also emphasized that it is not homologous with the paracymbium of Araneidae and Linyphiidae. Simultaneously Wunderlich (1978) had come to the same conclusion while using this character in synonymization of the family Hadrotarsidae with Theridiidae. Later Forster *et al*. (1990) recognized my finding using the terms hooked and hooded paracymbium respectively. To my mind the use of paracymbium in this context is clearly misleading. This has apparently been noticed also by Agnarsson (2004) who used the tems cymbial hook and cymbial hood. At the present it seems best to retain in this practice. Confusion also seems to surround the structure called the median apophysis by Levi (1961). In my above mentioned paper (Saaristo 1978) I showed that that there were two kinds of median apophysis sensu Levi (1961); one of them has a small apical pit and the the ejaculatory duct makes a loop inside it while the other type has no apical pit and is devoid of the ejaculatory duct. I (Saaristo 1978) also found that the cymbial hook fits into the pit of the first mentioned type while the the apex of the second type fits into the concavity under the paracymbial hood. Due the apparent function of these structures I called them locking arm A and B. I also was of the opinion that they are not homologous. However, I now think that this was an error and that they in fact are homologous structures. Accordingly it is apparent that paracymbial hood originated from the cymbial hook as also stated by Forster *et al*. (1990). Coddington (1990) who apparently missed my paper (Saaristo 1978) noticed that Levi´s (1961) median apophysis is a novel structure within araneoids and probably a synapopmorphy for the family Theridiidae and invented the term theridiid tegular apophysis (=TTA). Also, Forster *et al*. (1990) seemingly did not accapt the use of terminal apophysys in Theridiidae, placing the term inside the quatation marks. To make this all still wors Agnarsson (2004) apparently misunderstood Coddington´s (1990) paper and retained the use of terminal apophysis and used the term theridiid tegular apophysis for a structure called by Coddington (1990) the median apophysis and by me (Saaristo 1978) the terminal apophysis; in this paper I use the last mentioned term. Finally, as I already have suggested (Saaristo 1978) it seems desirably to use the term embolic complex instead of refering to that usually considerably complex structure simply as the embolus (see eg. Figs.20 and 35). In theridiids the actual embolus or embolus proper is mostly an elongated whip-like element turning clockwise in the left palp but sometimes short and almost tooth-like. In the left palp the embolus turns clockwise and in in right palp anticlocwise. In this study the following terminology is used: cymbial hook (CHO), cymbial pit (CPI), tegular apophysis containing a loop of seminal duct (TTA1), tegular apophysis devoid of seminal duct (TTA2), terminal apophysis (TAP), conductor (CON), embolic complex (ECO) and embolus (EMB).

The female copulatory organ consists of two main parts, viz. the external

epigyne and internal adnexae, which both have symmetrical right and left sections. The epigyne is formed by a more or less sclerotized plate bearing usually circular openings or entrance holes (EHO) on both sides of the median line and leading into the adnexae. Usually the entrance holes are situated in a common depression or atrium (ATR) or on both sides on a median elevation. Frequently there is a tongue-like median extension projecting from the posterior edge of the atrium and here called the atrial lingua (ALI). Most often the structures forming adnexae are called vulvae but this term is misleading and I therefore follow the practice used eg. by Roberts (1983). The adnexae includes entrance tubes (ETU) which start from the entrance holes and lead to the seminal receptaculae (SRE; paired in Hadrotarsinae) - from there the short fertilizing tubes (FTU) lead into the vagina.

Family Theridiidae Sundevall, 1833

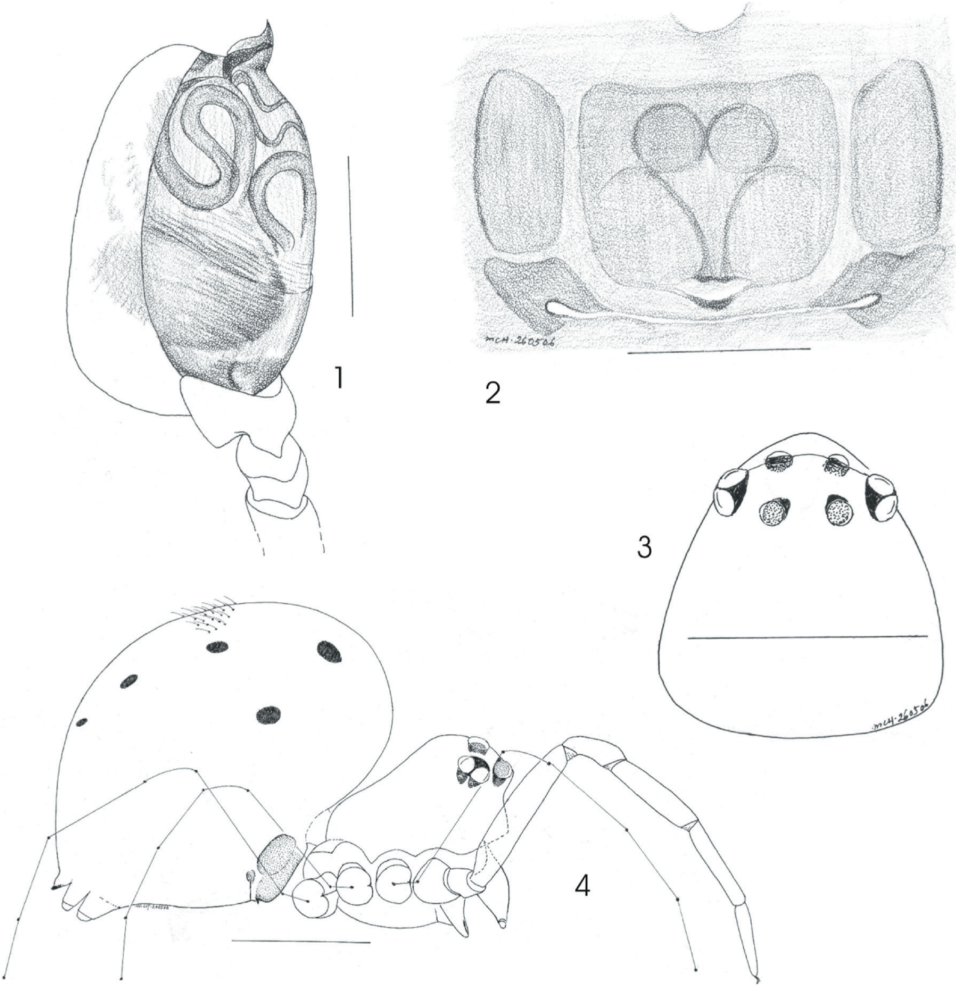
subfamily Hadrotarsinae Thorell, 1881

Diagnosis: The members of this subfamily are easily distinguished from the members of other theritiid subfamilies by having on the first tarsi specialized ventral setae with expanded tips, two pairs of seminal receptacules and dorsoventrally flattened claw of female palp. Further they have feeble basal part of chelicerae which are shorter than the length of clypeus while the fangs are usully long and thin.

Genus *Phycosoma* O. Pickard-Cambridge, 1879
Phycosoma O. Pickard-Cambridge, 1879d: 692. Type species by monotypy *Phycosoma oecobioides* O. Pickard-Cambridge, 1879 from New Zealand, Chatham Is.
Diagnosis: Male carapace transformed into a considerably high cylindrical turret.

Phycosoma martinae (Roberts, 1983) (Figs. 1-4)
Dipoena martinae Roberts, 1983: 227, f. 32-35 (Dm).
Dipoena japonica Yoshida, 1991e: 33, f. 2 (f, misidentified).
Dipoena decamaculata Chen, Peng & Zhao, 1992: 270, f. 1-5 (Dmf).
Dipoena coreana Paik, 1995: 32, f. 1-6 (Dm).
Dipoena ruedai Barrion & Litsinger, 1995: 454, f. 274a-j (Dm).
Dipoena martinae, Zhu 1998: 236, f. 154A-F (m, Sf).
-*”-,* Song Zhu & Chen, 1999: 112, f. 55C-D, K-L (mf).
-*”-,*Yoshida & Ono 2000: 132, f. 11-16 (mf, S).
Trigonobothrys Yoshida, 2002a: 14 (Tmf from *Dipoena*).
-*”-,* Yoshida, 2003a: 178, f. 493-498 (mf).
-*”-,* Sudhikumar, Mathew & Sebastian, 2004: 52, f. a-h (mf).
Phycosoma martinae, Platnick 2005 (Tmf from *Trigonobothrys*).
Specimens examined: Marianne, sweeping, 2$$, 23.10. 1999, coll. BirdLife (MZT AA 1.942).
Diagnosis: The species is much like *P. spundana* both being almost white coloured with four pairs of small, black dorsal pairs. However, *P. martinae* is almost half smaller and

easily recognized by having the abdominal hairs standing on small, strongly sclerotized, somewhat elevated bases (Fig. 4).
Description: Male well described by Roberts (1983). Female much like the male but the carapace is not turret-like.
Distribution: The species seems to have a wide distribution in old world tropics from Aldabra to India, China, Korea, Ryukyu Is., and Philippines (Platnick 2006). On the granitic Seychelles found on Marianne (Saaristo & Hill 2002 as *Dipoena menustya*).



Figs. 1-4 . *Phycosoma martinae* (Roberts, 1983). - 1: Male palp ventrally (redrawn from Roberts 1983). – 2: Epigyne. – 3: Female carapace dorsally. – 4: Female laterally. – Scale bars: Figs 1, 2 = 0.2 mm, Figs 3, 4 = 0.5 mm. - Orig.

Phycosoma spundana (Roberts, 1978) **n. comb.** (Figs. 5-12)

Dipoena spundana Roberts, 1978: 903, f. 1-4 (Dm).

Specimens examined: Aride, 1j., 1975, M. Mühlenberg leg.(MZT AA 0.201), 4$$1j., 27-28.02.1999, J.Cadbury & E. Andrews leg. (MZT AA 1.261-1.262), and 2subad.##2$$, June 1999, J. Bowler leg. (MZT AA 1.291 and 1.294); Cousin; 3##, 1978, Hugh Watkins leg. (MZT AA 0.200); Denis, sweeping, 2##4$$2juvs., April 2000, coll. BirdLife (MZT AA 1.944-1.946); North, sweeping, 2##3$$, Jan. 2000, coll. BirdLife (MZT AA 1.943); Silhouette, La Passe, 1#, 15.01.1999, Ron Gerlach leg. and Belle Vue, 1$, 14.01.1999, M. Saaristo & J. Gerlach leg. (MZT AA 0.895).

Diagnosis: The species may be recognized by its overall pale colouration with four pairs of dark spots on dorsal side of abdomen and two pairs of long and curved masrosetae among the sparsely sprickled hairs standing on small skerotized bases (Fig. 8)

Description: Male well described by Roberts (1978). Female much like the male but cephalothorax not elevated and abdomen globular (Fig. 10).

Distribution: The species may be endemic to Seychelles. On the granitic islands found on Aride (Bowler *et al*. 1999), Cousin, Denis, La Digue (Roberts 1978), North (Saaristo & Hill 2002) and Silhouette (Saaristo 1999).

subfamily Argyrodinae Simon, 1881

Discussion: I (Saaristo 2002) have thoroughly discribed all *Argyrodes* species found on the granitic Seychelles islands. At that time I was still following the then generally accepted views of delimiting of the theridiid genera presented by Levi & Levi (1962). However, Yoshida (2001b) followed by Agnarsson (2004) released *Ariamnes* Thorell, 1869, *Rhomphaea* L. Koch, 1872 from the synonymy with *Argyrodes* Simon, 1864. This affects the Seychellian Argyrodinae species and therefore it is necessary to list them here and create a new genus.

Genus *Argyrodella* n. gen.

Type species: *Argyrodes pusillus* Saaristo, 1978 from Seychelles.

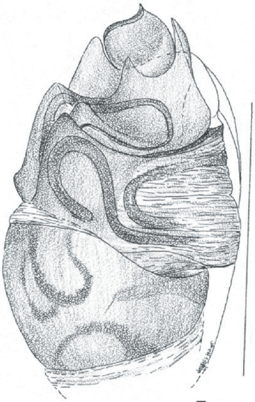
Diagnosis: Small species (CL=0.8–1.0). The general arangement of palpal sclerites as in *Argyrodes* although much simpler. Embolic complex bulbous with a short teeth-like embolus proper; terminal apophysis and conductor A totally translucent, more or less tongue-like; locking arm short, flat plate-like (Saaristo 1997, Figs. 165-169). Entrance holes of epigyne on either side of a median hump (Saaristo 2000, Fig. 2G).

Species included: Only the type species *Argyrodella pusillus* (Saaristo, 1978) **n. comb.**

Etymology: The generic epithet refers to the small size and and *Argyrodes*-like habitus of its type species. Gender feminine.

Genus *Argyrodes* Simon, 1864: 253. - Type species by subsequent designation (Petrunkevitch 1911: 170) *Linyphia argyrodes* Walckenaer, 1841 from France.

Not a senior synonym of *Ariamnes* Thorell, 1869, *Rhomphaea* L. Koch, 1872, or *Spheropistha* Yaginuma, 1957 (Agnarrson 2004: 476-489, after Yoshida 2001d: 183-184, contra Levi & Levi 1962: 16-27 and Tanikawa 1998a: 22),



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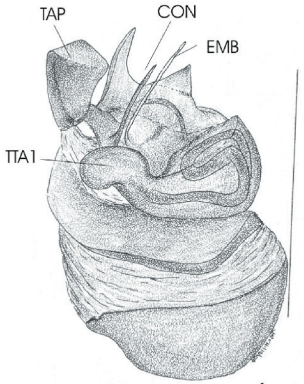

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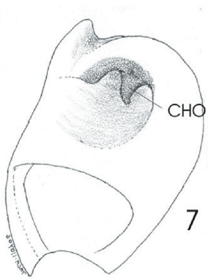

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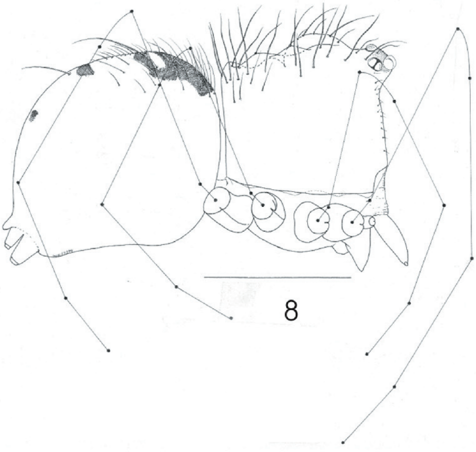

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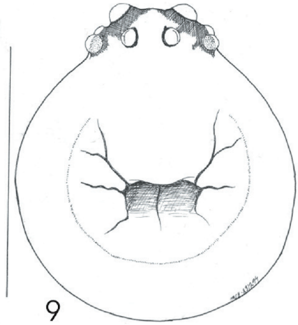

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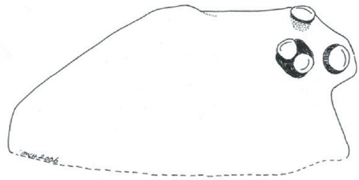

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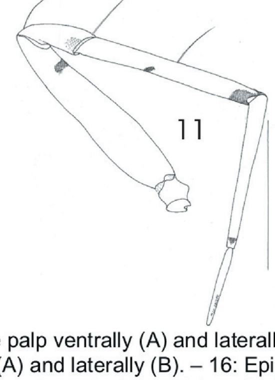

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Figs. 13-18. *Bardala labarda* (Roberts, 1983). –13: Male palp ventrally (A) and laterally (B). – 14: Cymbium ventrally. – 15: Epigyne anteroventrally (A) and laterally (B). – 16: Epigyne ventrally. – 17: Apical part of bulbus ventrally. – 18: Female laterally (A) and dorsally (B). – Scale bars: Figs 13-16 = 0.2 mm, Fig. 17 = 01. mm, Fig. 18 = 1.0 mm. - Orig.

Diagnosis: Abdomen more or less triangular. Male with projections on frontal part of the carapace. Medium sized – large species (CL=1.3-2.0)
*Seychellian species: Argyrodes argyrodes (*Walckenaer, 1841), *Argyrodes cognatus* (Blackwall, 1877), *Argyrodes* fissifrontella Saaristo, 1978, and *Argyrodes rostratus* Blackwall, 1877.

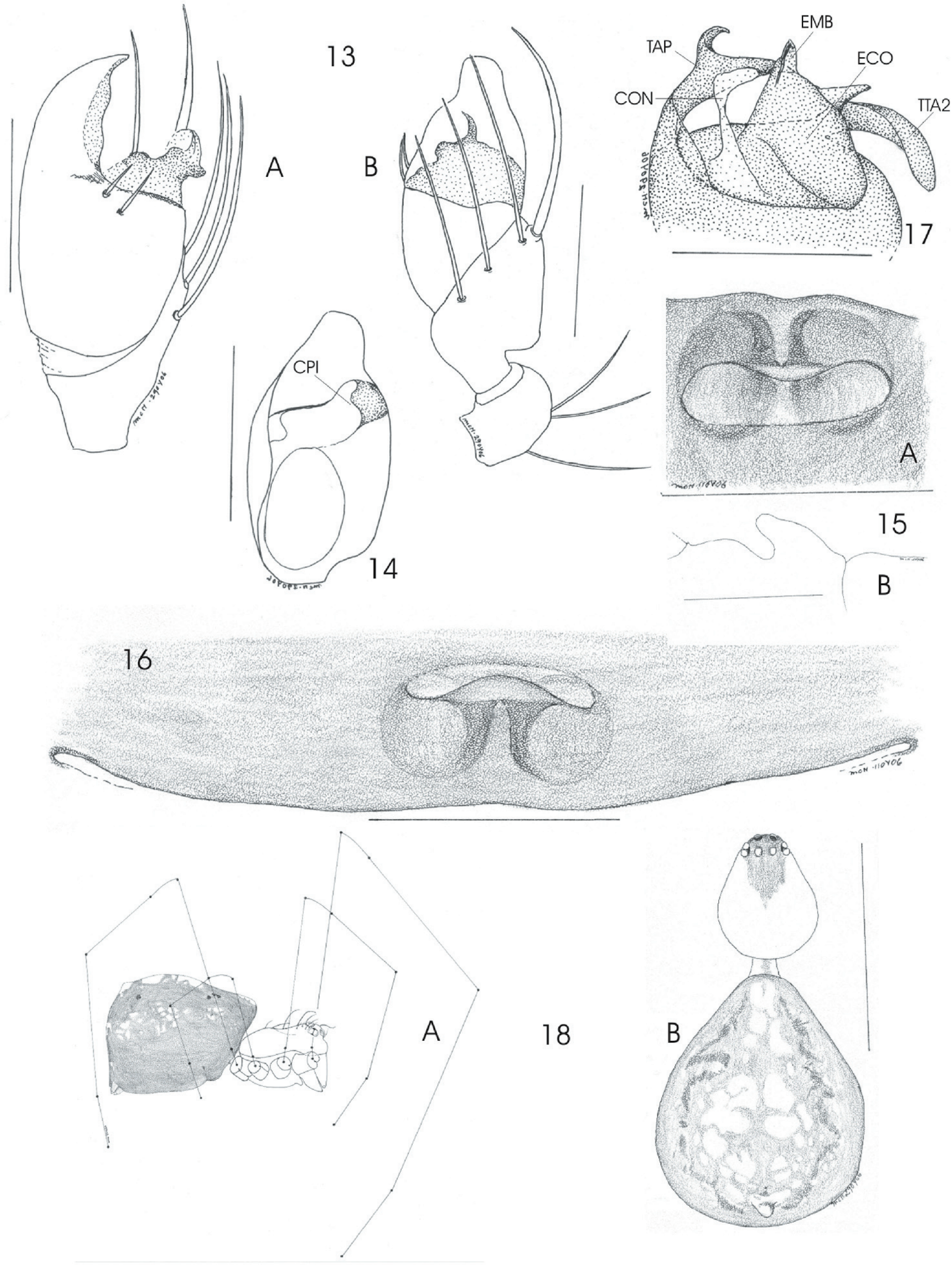
Genus *Rhomphaea* L. Koch, 1872: 289. – Type species by monotypy *Rhomphea cometes* L. Koch, 1872 from Samoa.
Removed from the synonymy of *Argyrodes* Simon, 1864 by Agnarrson 2004: 479, after Yoshida 2001d: 185-187, contra Levi & Levi 1962: 27.
Diagnosis: Clypeus strongly projecting. Abdomen elongated triangular or cylindrical. Male may have projection on the frontal part of the carapace. Medium sized species (CL=1.1–1.4).
Seychellian species: Rhomphaea barycephalus (Roberts, 1983) **n. comb.** and *Rhomphea recurvatus* (Saaristo, 1978) **n. comb.**

subfamily Theridiinae Sundevall, 1833

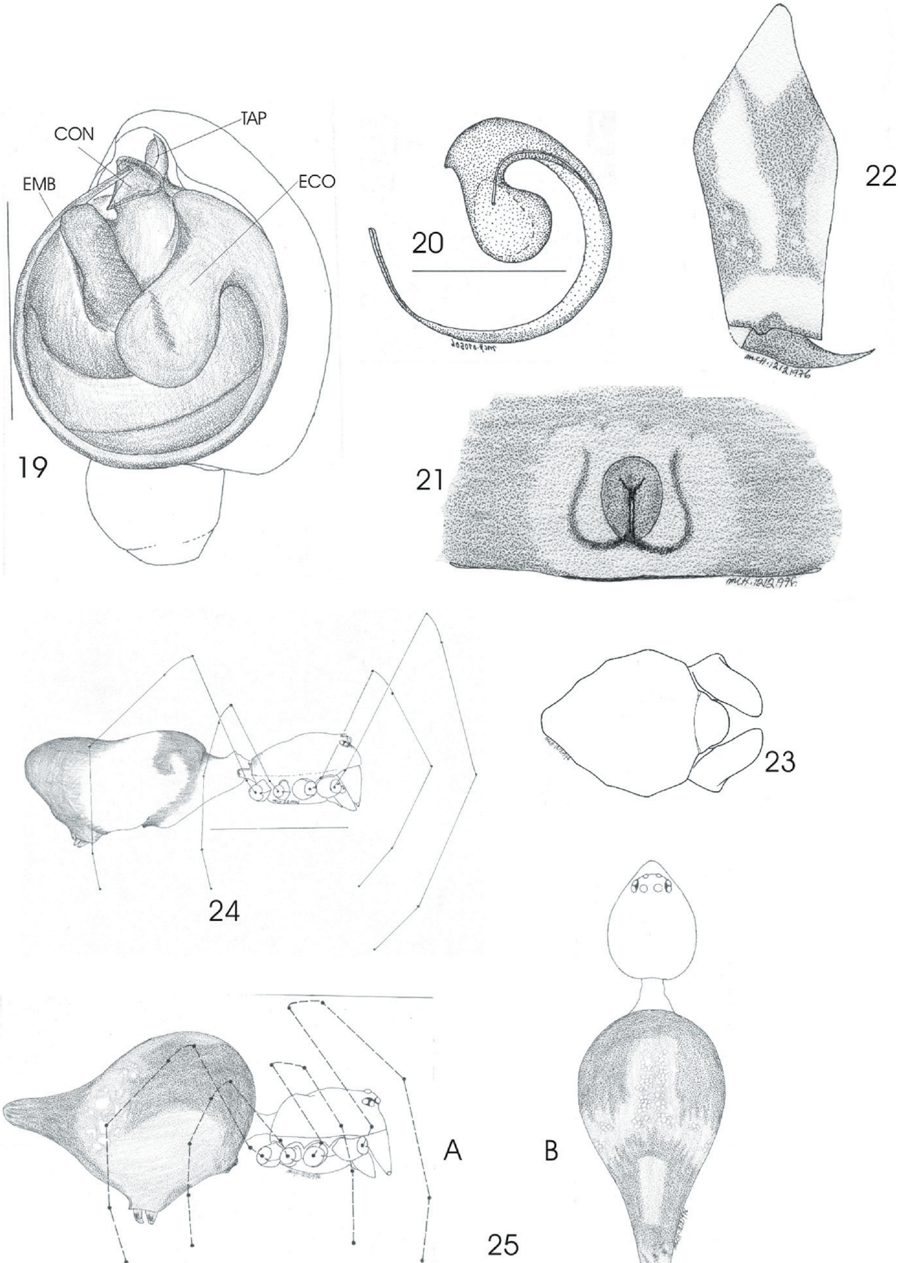
Diagnosis: Tegular apophysis (TTA2) always without looping ejaculatory duct, its apical part is inserted inside the cymbial pit (CPI). Primarily four tegular sclerites but they are frequently variously modified or even totally reduced.

Genus *Bardala* n. gen. - Type species *Achaearanea labarda* Roberts, 1982 from Aldabra, Seychelles.
Diagnosis: The genus is diagnosed by having the apex of the cymbium of the male palp claw-like extented and equiped with several macrosetae (Fig. 13). Female epigyne with transversaly elongated atrium bearing on its posterior edge an anteriorly pointing extension, entrance holes immidiatelly in front of the lip-like extension (Figs.15 and 16).
Etymology: The generic name is an acronym of the name of its type species. Gender feminine.

Bardala labarda (Roberts, 1982) **n. comb. (**Figs. 13-18.)
Achaearanea labarda Roberts, 1982: 228, f. 38-49 (Dmf).
Specimens examined: Aldabra, Picard, 5##1subad# 7$$,1974-1975, R. Prys-Jones leg. (MZT AA 2.474), Aride, 4$$, 1975, M. Mühlenberg leg. (MZT AA 0.227) and litter sampling, 1$, July-November 2000, John Bowler leg. (MZT AA 2.139); Denis, sweeping, 2juvs, Oct. 1999, coll. BirdLife leg. (MZT AA 1.839); Cousin, sweeping, 4##1$, March 2000, coll. BirdLife leg. (MZT AA 1.841-1.844); Marianne, sweeping., 1#4$$, 23.10. 1999, coll. BirdLife leg. (MZT AA 1.840)



Figs. 13-18. *Bardala labarda* (Roberts, 1983). –13: Male palp ventrally (A) and laterally (B). – 14: Cymbium ventrally. – 15: Epigyne anteroventrally (A) and laterally (B). – 16: Epigyne ventrally. – 17: Apical part of bulbus ventrally. – 18: Female laterally (A) and dorsally (B). – Scale bars: Figs 13-16 = 0.2 mm, Fig. 17 = 01. mm, Fig. 18 = 1.0 mm. - Orig.



Figs. 19-25. *Coleosoma blandum* O. Pickard-Cambridge, 1882. – 19: Male palp ventrally. – 20: Embolic complex ventrally. – 21: Epigyne ventrally.– 22: Female chelicer frontally. – 23: Sternum of female ventrally. – 24: Male laterally. – 25: Female laterally (A) and dorsally (B). – Scale bars: Figs 19-23 = 0.2 mm, Figs 24, 25 = 1.0 mm. – Orig.

Diagnosis: This pale coloured, long and slender legged species can be recognized by the pink coloured ocular area and the laterodorsal pinkish bands on abdomen (Fig. 18). Also the male and female copulatory organs are very characteristic (Figs. 13–16).
Description: Well described by Roberts (1983).
Distribution: This endemic species has been found on Aldabra (Roberts 1983) and Aride (Boeler *et al*. 1999), Denis (Saaristo & Hill 2002), Cousin (Saaristo & Hill 2002) and Marianne (Saaristo & Hill 2002).

Genus *Coleosoma* O. Pickard-Cambridge, 1882
Coleosoma O. Pickard-Cambridge, 1882: 426. - Type species by monotypy *Theridion blandum* O. Pickard-Cambridge, 1882 from Sri Lanka.
Diagnosis: Relatively small species with pronounced sexual dimorphism; males are thought to be ant mimics. Abdomen of male elongate, anteriorly constricted with rather ill-defined scutum. Stridulating picks on an anterodorsal projection of the abdomen. Shape of female abdomen variable but basically globular, higher than wide.

Coleosoma blandum O. Pickard-Cambridge, 1882 (Figs. 19-25.)
Coleosoma blandum O. Pickard-Cambridge, 1882: 427, pl. 29, f. 3 (Dm).
-*"*-, Keyserling, 1884: 212, pl. 10, f. 129 (Df).
Chrysso acrobeles, Saaristo 1978: 117, f. 170-174 (Tf from *Theridion*, = *Theridion conurum*).
Coleosoma blandum, Roberts 1978: 915, f. 27-30 (f, = *Chrysso acrobeles* = *Theridion conurum*).
N.B. For more references see Platnick (2005).
Specimens examined: Aride, 1m, 19.07.1975, M. Mühlenberg leg. (MZT AA 0.202); Bird, on *Scaveola sericea*, 2juvs., 04.04.2001, J. Gerlach leg. (MZT AA 2.189); Cousin, 9##1$2juvs., April 1978, Hugh Watkins leg.(MZT AA 0.203-0.206) and sweeping, ##m9$$6juvs., Dec. 1999, coll. BirdLife (MZT AA 1.904-1.908); Denis, sweeping, 6$$3juvs., April 2000, coll. BirdLife (MZT AA 1.895-1.899); Mahé, near the Reef hotel, 1$, 24.10.1975, M. Saaristo leg. (MZT AA 0.034); Marianne, sweeping, 5$$7juvs, 23.10.1999, coll. BirdLife (MZT AA 1.900-1.901); North, sweeping, 1juv., May 1999, coll. BirdLife (MZT AA 1.907), Silhouette, Anse Cimitiere, 3##10$$3juvs, 18.01.1999, M. Saaristo leg. (MZT AA 0.892) and La Passe, 3##13$$, 11.01.1999, M. Saaristo leg. (MZT AA 0.893 and 0.894); Therese, sweeping, 2$$5juvs, Sept. 1999, coll. BirdLife (MZT AA 1.902-1.903).
Diagnosis: The male can be recognized by the broad cymbium and bulbus (Fig. 19) and sickle-shaped embolus with tear-shaped basal part (Fig. 20) and heavily built anterodorsal projection of the abdomen (Fig. 24). Female easily recognized by the conical posterior extension of the abdomen (Fig. 25).
Description: Total length 1.65-1.95mm; carapace 0.60mm. Cephalothorax and palps brown, strongly suffused with black. Legs whitish; inner sides of femora I, II and IV

usually with long black stripe, coxae often marked with black as well as apikal parts of tarsi and proximal parts of metatarsi. Abdomen blackish with large, dirty white area laterally and ventrally about at its middle. Abdomen of male elongate with rather long, neck-like constriction anteriorly, that of female globular with conical posterior extension. Abdomen of subadult male like that of female. Epigyne of female with a dark, median egg-shaped area including Y-shaped structure from which starts anteriorly pointing S-shaped ducts.
Distribution: This is a paleotropical species which has been found on Aride (Bowler *et al.* 1999), Cousin, Cousine (Saaristo 1999), Denis (Saaristo & Hill 2002), Mahé (Saaristo 1978: *Chrysso acrobeles*, and 1999, Roberts 1978), Marianne (Saaristo & Hill 2002), Silhouette (Saaristo 1999) and Therese (Saaristo & Hill 2002).

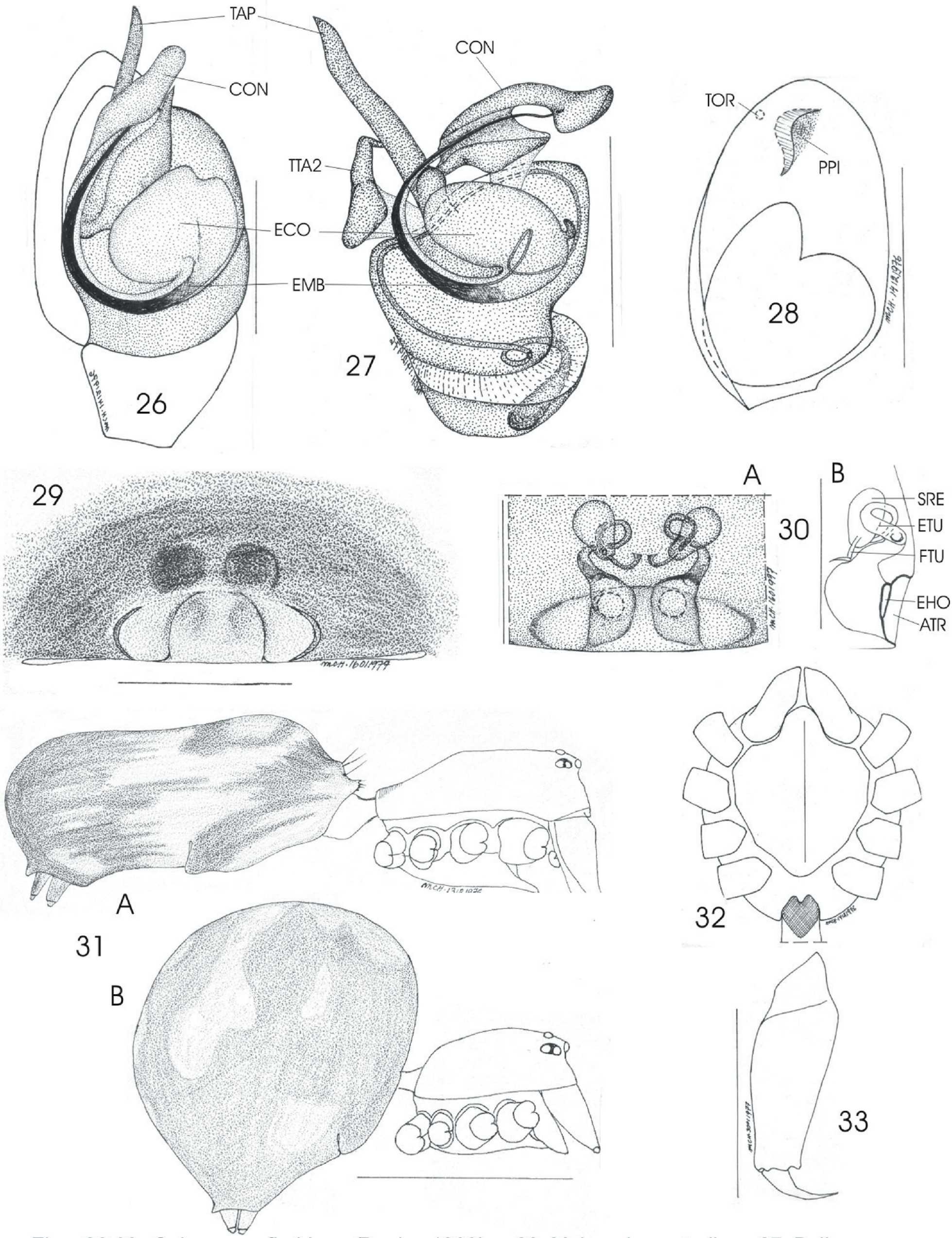
Coleosoma floridanum Banks, 1900 (Figs. 26-33)

Coleosoma floridana Banks, 1900: 98 (Dm).

-*"-,* Levi 1967c: 181, f. 32-36 (mf).

-*"-,* Saaristo 1978: 117, f. 175-182 (mf).

N.B. For more references see Platnick 2005.
Specimens examined: Cocos ('Albatross'), 2##, 29.09.1975, M. Mühlenberg leg. (MRAC 177.109); Aride, 1#1$, 13.08.1975, M. Mühlenberg leg. (MZT AA 0.207 and 0.208) and litter sampling, 1$, July-November 2000, John Bowler leg. (MZT AA 2.137: Conception, sweeping., 1#, Sept. 1999, coll. BirdLife leg. (MZT AA 1.939) and pitfall, 1#, 27.02. 2000, coll. BirdLife leg. (MZT AA 1.917); Cousin, 6m5f, April 1978, Hugh Watkins leg.(MZT AA 0.209-0.216), by pitfalls, 2##1$1juv., 1999, coll. BirdLife leg. (MZT AA 1.921-1.924), and sweeping., 1$, Dec. 1999, coll. BirdLife leg. (MZT AA 1.938); Cousine, 6##11$$2juvs, 23-25.01.1999, M. Saaristo leg. (MZT AA 0.874-0.879); Curieuse, by pitfalls, 3$$2juvs, 2000, coll. BirdLife leg. (MZT AA 1.925-1.928) and sweeping., 3$$, January 2000, coll. BirdLife leg. (MZT AA 1.936-1.937); Grande Soeur, 15##1$, 10. and 17.09.1975, M. Mühlenberg leg. (MRAC 177.096, 177.105, 177.114, 177.134, 177.135, 177.147, 177.148, 177.150, 177.152, 177.157, 177.158, 177.160, 177.179); Denis, by pitfalls, 3juvs, 1999-2000, coll. BirdLife leg. (MZT AA 1.919-1.920, 2.097) and sweeping., 1subad.#.13$$42juvs, April 2000, coll. BirdLife leg. (MZT AA 1.930-1.935, 1.940); Felicite, by pitfalls, 1$, 14.11. 1999, coll. BirdLife leg. (MZT AA 1.918); Mahé, ca. 5kms west from the Reef Hotel (600 elv.), 1#1$, 25.10.1975, M. Saaristo leg. (MZT AA 0.035), Le Niol, 4##21$$3juvs, June 1994, J. Gerlach leg. (MZT AA 0.306, 0.307 and 0.880); Petite Soeur, 3##1$, 17.09.1975, (MRAC 177.162 and 177.180); Marianne, by pitfalls, 3##10$$, 26.10. 1999, coll. BirdLife leg. (MZT AA 1.910-1.916); North, 2$$, 30.07.2000, J. Gerlach leg., M. Saaristo det. (MZT AA 1.404) and by pitfalls, 2$$1juv., 30-31.01.2000, coll. BirdLife leg. (MZT AA 1.929, 2.098); Praslin, 1#, 28.10.1975, M. Saaristo leg. (MZT AA 0.036); Silhouette, various places, 21##68$$4juvs, 07-24.01.1999 M. Saaristo and J. Gerlach leg. (MZT AA 0.846-0.872), Coco dans Trou, 1#, 26.07.1998, J. Gerlach leg. (MZT AA 0.873), and Belle Vue, (pitfall traps), 2##3$$, 16-20.07.1999, J. Gerlach leg. (MZT AA 1.305)

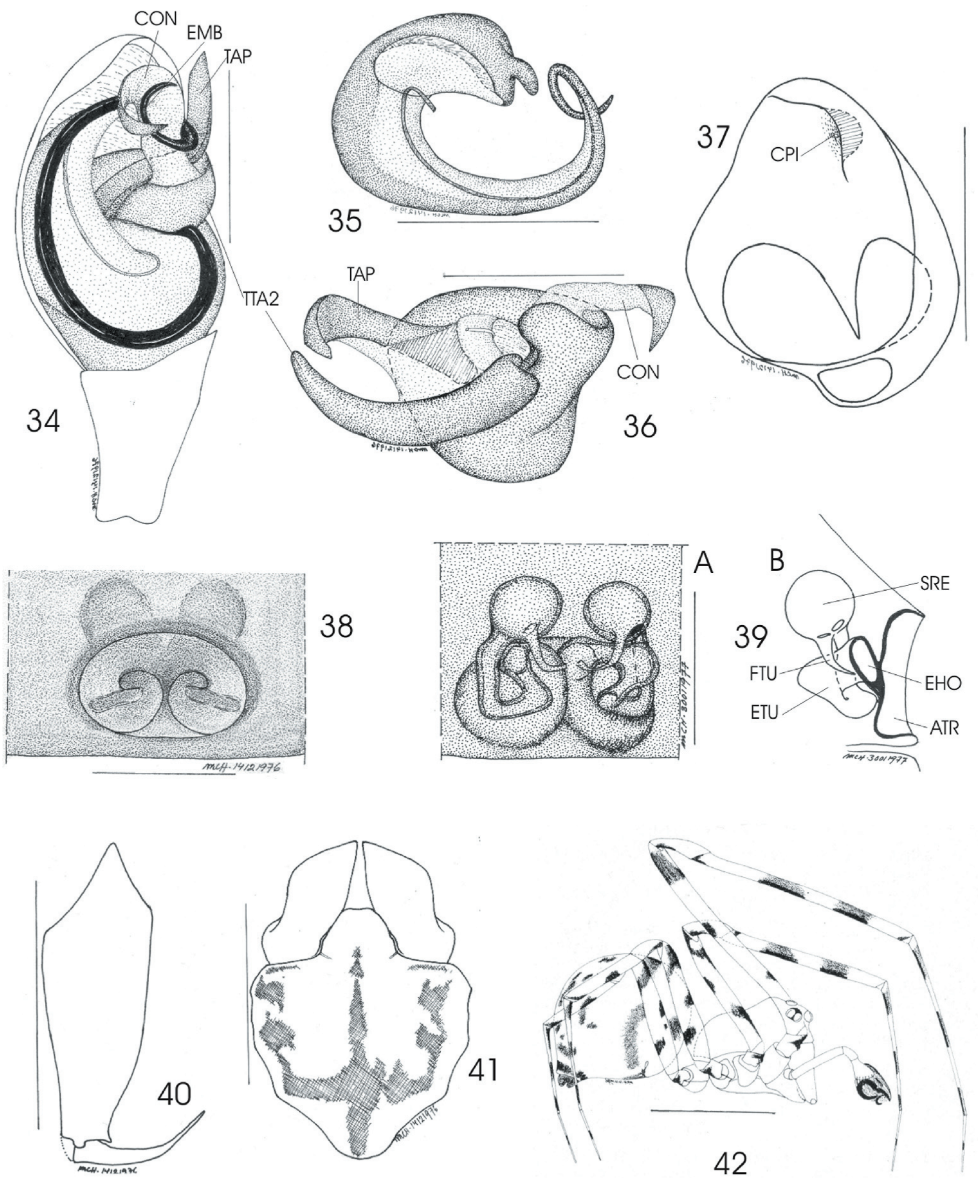


Figs. 26-33. *Coleosoma floridana (*Banks, 1900). – 26: Male palp ventrally. – 27: Bulbus treated with KOH laterally. – 28: Cymbium ventrally. – 29: Epigyne ventrally. – 30: Adnexae dorsally (A) and laterally (B). – 31: Male (A) and female (B) laterally. – 32: Sternum of female ventrally. – 33: Chelicer of female frontally. – Scale bars: 26-30 = 0.2 mm, 31 = 1.0 mm, 32, 33 = 0.5 mm. – Orig.

Diagnosis: The male remainds that of *C. blandum* but the cymbium and bulbus are narrower and base of embolus circular bearing a small lateral hook (Fig. 27). Abdomen of female somewhat egg-shaped higher than wide with distinct pattern of large pale areas of dark back-ground (Fig. 31B). Epigyne somatimes difficult the detect but basicly there is a pale oval-shaped transversely lying oval-shaped atrium immidiatelly anteriorly from the epigastric furrow and a pair of dark spherical circles or tranlucent seminal receptaculae.
Description: The species has been adequately described by Levi (1967) and Saaristo (1978).
Distribution: Pantropical, greenhouses in Europe (Platnick 2005). This is a well-known cosmopolitan species and often locally quite abundant. Found on the following islands: Aride (Bowler *et al*. 1999), Cocos, Conception (Saaristo & Hill 2002), Cousin (Saaristo & Hill 2002), Cousine (Saaristo 1999), Curieuse (Saaristo & Hill 2002), Denis (Saaristo & Hill 2002, Felicite (Saaristo & Hill 2002), Grande Soeur, La Digue (Roberts 1978), Mahé (Saaristo 1978, 1999), Marianne (Saaristo & Hill 2002), North (Saaristo & Hill 2002), Petit Soeur (Saaristo & Hill 2002), Praslin (Saaristo 1978, Roberts 1978) and Silhouette (Roberts 1978, Saaristo 1999).

Genus *Keijia* Yoshida, 2001
Keijia Yoshida, 2001: 169. – Type species by original designation *Keijia maculata* Yoshida, 2001 fom Japan.
Diagnosis: The genus is distinguished by having a spherical pale coloured abdomen with several black flecks and spots, legs and sternum also with dark markings.

Keijia mneon (Bösenberg & Strand, 1906) (Figs. 34-42)
Theridion mneon Bösenberg & Strand, 1906: 142, pl. 12, f. 286 (Df).
Theridion adamsoni Berland, 1934a: 102, f. 6-9 (Df).
-*"*-, Levi 1967c: 181, f. 20-23 (mf).
Coleosoma adamsoni, Saaristo 1978: 117, f. 183-191 (Tm from *Theridion*, Df).
Keijia mneon, Yoshida,2001c: 172, f. 8, 53-55 (Tf from *Theridion*, = *adamsoni*).
N.B. For more references see Platnick 2005.
Specimens examined: Aldabra, Picard, 1$**,** Dec. 2000, Pat Matyot leg.(MZT AA 2.245); Cousine, 1#, 23.01.1999, M. Saaristo leg. (MZT AA 0.891); Denis, sweeping, 7##5$$8juvs, Oct. 1999 and April 2000, coll. BirdLife (MZT AA 0.920, 1.886-1.893); Mahé: the Reef Hotel, in *Casuarina* bushes, 1#1$, 27.10.1975, M. Saaristo leg. (MZT AA 0.037) and 1#, 29.12.1993, J. Gerlach leg. (MZT AA 0.920); Marianne, sweeping, 1juv., 23.10.1999, coll. BirdLife (MZT AA 1.894); Silhouette, various places, 5##5$$4juvs, 09-20.01.1999, M. Saaristo and J. Gerlach leg. (MZT AA 0.882-0.890).
Diagnosis: Both male and female have a spherical pale coloured abdomen with several black flecks and spots, legs and sternum also with dark markings (Fig. 42). Embolic complex with a basal crook and sickle-shaped embolus (Fig. 34-5). Epigynal atrium elliptical with shallow groowes leading to central epigynal openings (Fig. 38-9).



Figs. 34-42. *Keijia mneon* (Bösenberg & Strand, 1906). – 34: Male palp ventrally – 35: Embolic complex ventrally.– 36: Apical part of bulbus laterally with embolus detached, treated with KOH. – 37: Cymbium ventrally. – 38: Epigyne ventrally. – 39: – Adnexae dorsally (A) and laterally (B). – 40: Male chelicer frontally.– 41: Sternum of male ventrally. – 42: Male laterally. – Scale bars: Figs 34-39 = 0.2 mm, 40, 41 = 0.5mm, Fig. 42 = 1.0 mm. – Orig.

Description: The species has been adequately described by Levi (1967) and Saaristo (1978).
Distribution: This pantropical species has been found on Aldabra, Denis (Saaristo & Hill 2002), Cousine (Saaristo 1999), Mahé (Saaristo 1978, 1999, Roberts 1978), Marianne (Saaristo & Hill 2002), and Silhouette (Saaristo 1999).

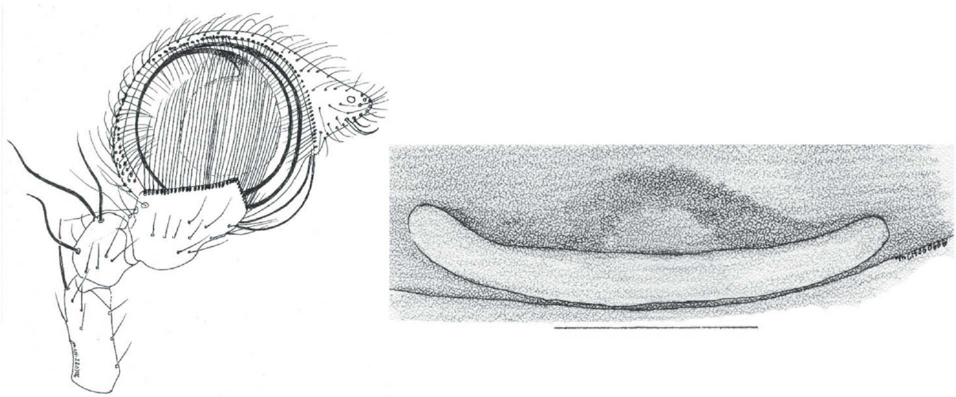
Genus *Kochiura* Archer, 1950

Kochiura Archer, 1950: 16. - Type species by original designation and monotypy *Theridium aulicum* C. L. Koch, 1838 from Greece.
N.B. Removed from the synonymy of *Anelosimus* Simon, 1891 by Agnarsson, 2004: 476, contra Levi, 1956b: 412.
Diagnosis: Apex of cymbium deeply devided but unequally so, the dorsal process being the lesser of the two. Embolus thread-like, forming several coils (Fig. 43). Epigyne with a wide and narrow, transverse atrium (Fig. 44).

Kochiura aulica (C. L. Koch, 1838) (Figs. 43-44)

Theridion aulicum C. L. Koch, 1838: 115, f. 323 (Df).
Kochiura aulica, Archer 1950: 16, pl. I, f. 3 (Tmf from *Theridion*).
Theridion aulicum, Locket & Millidge 1953: 61, f. 41A-B (mf).
Anelosimus aulicum, Levi 1956b: 412.
-"-, Roberts, 1985: 181, f. 80c (mf).

N.B. For more references see Platnick 2006.
Specimens examined: FRANCE: Corsica, San Bastiano, in vegetation of macchia, 1#1$, 22.V.1972, P. T. Lehtinen leg. (MZT AA 3.715).
Diagnosis: Abdomen of both sexes with similar dorsal pattern as *S. placens* but median stripe grey, thinly edged with black. Embolus thread-like, forming several coils (Fig. 43). Epigyne with a wide and narrow, transverse atrium (Fig. 44).
Description: Well described by e.g. by Wiehle (1937) and Locket & Millidge (1973).



Figs. 43-44. *Kochiura aulicum* (C. L. Koch, 1838). – 43: Male palp laterallyally. – 44: Epigyne ventrally. – Scale bars: 0.2 mm. – Orig.

Distribution: Canary Is., Cape Verde Is. to Azerbeijan (Platnick 2006). Only one old record from Mahé (Simon 1893).

Genus *Moneta* O. Pickard-Cambridge, 1870
Moneta O. Pickard-Cambridge, 1870: 736. - Type species by monotypy *Moneta spiniger* O. Pickard-Cambridge, 1870 from Sri Lanka.
N.B.: Removed (along with its junior synonym *Hyptimorpha* Strand, in Bösenberg & Strand, 1906) from the synonymy of *Episinus* Walckenaer, 1809 by Okuma, 1994: 16, contra Levi & Levi, 1962: 24.
Diagnosis: Moneta species may be recognized by having the eyes in dorsal view in two more or less parallel rows.
Discussion: Moneta was synonymized with *Episinus* Walckenaer in Latreille, 1809 by Levi & Levi (1962). Recently, Okuma (1994) has removed *Moneta* from the synonymy of *Episinus*; I am in full agreement with him.

Moneta coercervus (Roberts, 1978) **n. comb. (**Figs. 45-47)

Moneta spiniger, Simon 1898: 376 (misidentification).

Episinus coercervus Roberts, 1978: 921, f. 39-43 (Dmf).

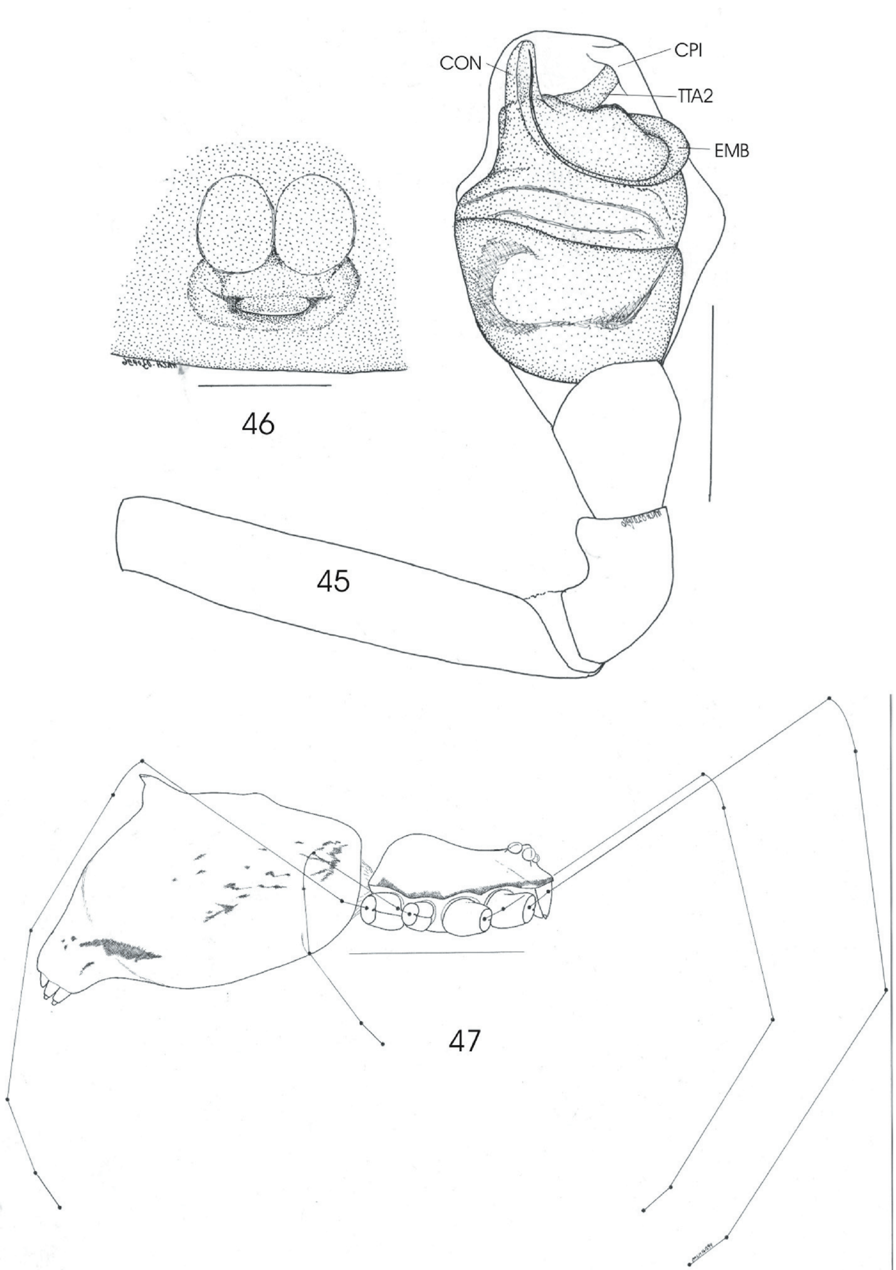
Specimens examined: Mahé, Mt. Crève Coeur, versant Ouest, 300 m, holotype female and allotype male of *Episinus coercervus*, June 1972, P.L.G. Benoit & J.J. van Mol leg. (MRAC 144.719 and 150.211).
Diagnosis: The species may be recognized by the unpaired dorsomedian teeth on the abdomen (Fig. 47) and the male palp (Fig. 45) and epigyne (Fig. 46).
Description: The species has been well described by Roberts (1978).
Distribution: This endemic species has been found on Mahé (Roberts 1978) and Silhouette (Simon 1898: *Moneta spiniger*).

Genus *Nanume* n. gen.
Type species *Theridion naneum* Roberts, 1983 from Seychelles.
Diagnosis: The genus is characterized by the colourless lateral eyes (Fiog. 50). Also the male and female copulatory organs apparently are diagnostic (Figs. 48 and 49)

Nanume naneum (Roberts, 1983) **n. comb. (**Figs. 48-50)

Theridion naneum Roberts, 1983: 231, f. 56-61 (Dmf).

Specimens examined: Cousin, sweeping, 1f, March 2000, coll. BirdLife (MZT AA 1.941)
Diagnosis: This very pale colored small species (TL=1.1-1.4) is easily recognized by the colourless lateral eyes, dark coloured median eyes form a regular square (Fig. 50).
Description: Well described by Roberts (1983).
Distribution: Aldabra (Roberts 1983) and Cousin.



Figs. 45-47. *Moneta coercervus* (Roberts, 1978). – 45: Male palp ventrally. – 46: Epigyne ventrally. – 47: Male laterally. – Scale bars: Figs 45, 46 = 0.2 mm, Fig. 47 = 0.5 mm. – Orig.

Genus *Nesticodes* Archer, 1950

Nesticodes Archer, 1950: 22. - Type species by original designation and monotypy *Theridion rufipes* Lucas, 1846 from Oran, Algeria;

Removed from the synonymy of *Theridion* Walckenaer, 1805 by Wunderlich, 1987a: 214, contra Levi, 1957a: 19.

Diagnosis: This monotypic genus is diagnosised by the peculiar epigyne consisting of a median conical elevation bearing on its anterior side the atrium equipped with large atrial lingua.

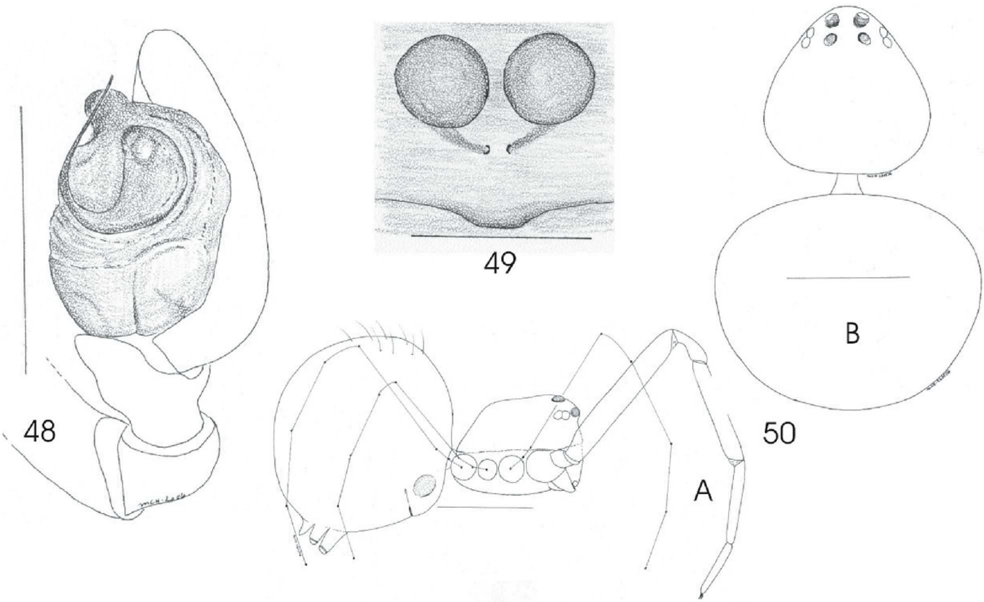
Nesticodes rufipes (Lucas, 1846) (Figs. 51-54)

Theridion rufipes Lucas, 1846: 263, pl. 16, f. 5 (Df).
-*"-,* Simon 1898b: 271 (Dm).
-*"-,* F. O. P.-Cambridge 1902a: 384, pl. 36, f. 15-16 (mf).
Theridion rufipes, Levi 1957a: 56, f. 188-193 (mf).
-*"-,* Roberts 1978: 913, f. 20-26 (mf).
Nesticodes rufipes, Wunderlich 1987a: 215, f. 570 (mf).
-*"-,* Agnarsson 2004: 573, f. 58A-F, 59A-F (mf).

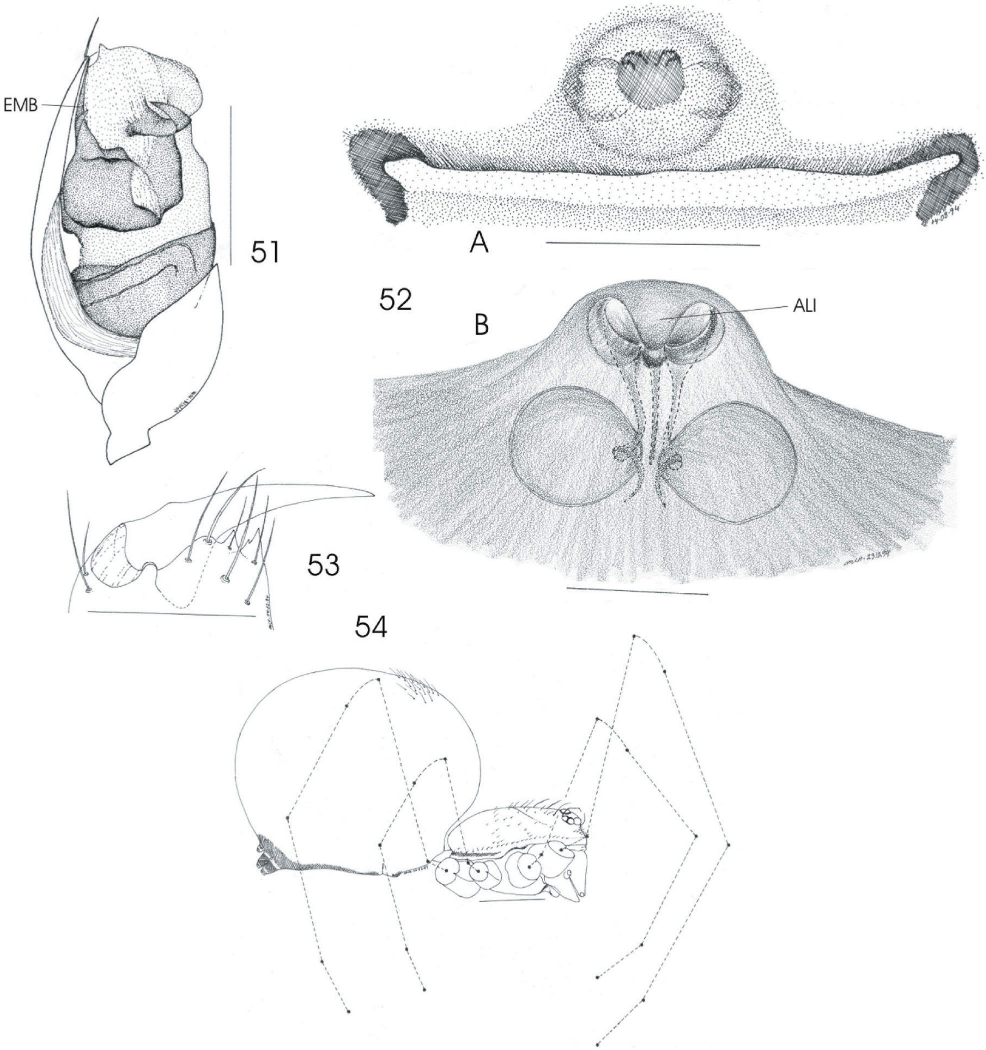
N.B. For more references see Platnick 2005.

Specimens examined: SEYCHELLES: Cousin. 1$, April 1978, Hugh Watkins leg. (MZT AA 0.225). SUDAN: Khartum, 1#4$$, 1964 (MRAC 133.722).

Diagnosis: Male easily recognized by the thin, anteriorly pointing embolus (Fig. 51) and female by the large median elevation on the epigyne (Fig. 52).



Figs. 48-50. *Nanume naneum* (Roberts, 1983). – 48: Male palp ventrally (redrawn from Roberts 1983). – 49: Epigyne ventrally. – 50: Female laterally (A) and dorsally (B). – Scale bars: Figs 48, 49 = 0.2 mm, Fig. 50 = 0.5 mm. – Orig.



Figs. 51-54. *Nesticodes rufipes* (Lucas, 1846). – 51: Male palp ventrally. – 52: Epigyne ventrally (A) and posteroventrally (B). – 53: Apical part of female chelicer. – 54: Female laterally. – Scale bars: Figs 52-53 = 0.2 mm, Fig. 54 = 1.0 mm. – Orig.

Description: Rather large species (TL of male = 2.8-3.7mm, of female = 4.2-5.3mm; LC of male = 1.3-1.7mm, of female = 1.6-2.2mm); virgin female about the same size as male but the abdomen of fertilized female really large, spherical. Cephalothorax and legs bright yellow-brown; abdomen grey, dorsally and laterodorsally with snow-white patches formed by guanine corpuscles, ventrally with broad longitudinal band starting behind epigastric furrow running backwards to surround the spinnerets; carapace and appendages orange brown (Fig. 66). Chelicerae with two anterior teeth, median one

with tiny subtooth, no posterior tooth. Legs rather long, relatively heavily built with one dorsal spine on patella and tibia. Female palpal claw comb-like. Abdomen fairly thickly covered with yellow brown hairs arising from narrowly sclerotized bright brown bases. Spinnerets and anal tubercle strongly chitinized; tracheal spiracle with narrowly chitinized edges. No dorsal stridulatory organ. No colulus.
Distribution: This is a very commom pantropical species (Platnick 2006) both in Old and New World which has not earlier been recorded from Seychelles. At the present, found only on Cousin.

Genus *Parasteatoda* Archer, 1946: 22: 38. - Type species by original designation *Theridium tepidariorum* C.L. Koch, 1841 from Germany (in greenhouses of the botanical gardens at the University of Erlangen!).
Diagnosis: Males with simplified palpus. There is no terminal apophysis; embolic complex and tegular apophysis basally fused together and connected with a common membranous stalk to the tegulum; conductor strongly developed, curved groove, attached to the tegulum by a membrane (Fig. 60 and 61). Epigynal atrium elliptical with shallow grooves leading to the entrance holes (Fig. 62).
Males small but not minute, one-third to two-thirds the size of the females. Stridulating apparatus of the male present as a partial lunate plate either side of the pedicel. Chelicerae non-geniculate.
Discussion: Parasteatoda was synonymized with *Achearanea* by Levi (1955). However, the secondary genital organs of these two genera are so different that *Parasteatoda* is herein revalidated.

Parasteatoda mundula (L. Koch, 1872) **n. comb. (**Figs. 55-59)

Theridion mundulum L. Koch, 1872a: 263, pl. 22, f. 3 (Df).
Theridion amoenum Thorell, 1877b: 463 (Df).
“-, Workman 1896: 68, pl. 68 (f).
-”-, Hogg 1919: 83 (Dm).
Achaearanea mundula, Chrysanthus, 1963: 741, f. 76-77, 83 (Tmf from *Theridion*).
-”-, Roberts 1978: 913.
-”-, Zhu 1998: 100, f. 59A-C (f).
-”-, Song Zhu & Chen, 1999: 91, f. 40I-J (f).

Specimens examined: Mahé, no other data, 1$, (MRCA 136.896). (PAPUA NEW GUINEA, Central d., Goila subd., Avios, 1#, 19-20.02.1974, H. Hippa leg. (MZT AA 3.724) and Port Moresby, in vegetation, 1$11juvs, 10.10.1973, Jyrki Nieminen leg. (MZT AA 3.725)
Diagnosis: The male is recognized by the bulbous palp with a groove-like conductor enclosing the apical part of the whip-like embolus (Fig. 55). Epigyne of female with oval atrium with small entrance holes on its either sides.
Description: Carapace pale yellow with dark lateral bands (Fig. 57). Sternum yellowish with blackish posterior area. Colour pattern of abdomen complicated, dorsally with a brownish folium with darker edges (Figs. 58 and 59). Legs rather thick, annulated or

the apical parts of femur, tibia and metatarsus dark coloured as well as ventral side of patella. Fovea very low

Distribution: This is a paleotropical species found from India to New Caledonia (Platnick 2006). Only one female has been collected from Seychelles; Mahé (Roberts 1978)

Discussion: The species was originally described from a single female captured in the environs of Merauke, Indonesia New Guinea. In 1877 Thorell described another species, *Theridion amaenum*, also from a female and collected from Celebes. This species was later synonized by Thorell himself (1895) with *T. mundulum*. In 1963 Chrysanthus transferred *T. mundulum* to *Achaearanea* and described a new subspecies for it, e.g. *Achaearanea mundula papuana*, and again only the female was available. He also figured the vulva of all three above mentioned taxa. Of *A. mundula* he had at his disposal the holotype and of *A. amaena* (*amoena* by Chrysanthus) several specimens partly identified by Thorell. The vulva of the Seychellian specimen agree totally with that of the holotype of *A. mundula* (Chrysanthus 1963: Fig. 77). On the other hand, the vulvas of *A. amaena* and *A. mundula papuana* (Chrysanthus 1963: Figs. 83 & 82) which are practically identical differ considerably from that of *A. mundula*. It is probable that the type of *A. amaena* has been lost but assuming that Chrysanthus' (1963) figure represent a real *A. amaena* its synonymy with *A. mundula* must be rejected while *A. mundula papuana* is a junior synonym of *A. amaena*, **n. syn.** Chrysanthus (1963) also synonymized the Central American *Achaearanea tesselata* (Keyserling, 1884) with *A. mundula*. At present this synonymity is uncertain.

Parasteatoda tepidariorum (C. L. Koch, 1841) (Figs. 60-63)

Theridion tepidariorum, C. L. Koch, 1841a: 75, f. 646-648 (Df).

Achearenea tepidariorum, Levi 1955a: 32, f. 69-70, 83-84 (mf).

-"-, Agnarsson 1996: 52, f. 35A-B (mf).

N.B. For more references see Platnick 2005.

Specimens examined: FINLAND: Joensuu, Botanical Garden, inside greenhouses, 2##2$$, 22.10.1987, M. Huttunen leg.

Diagnosis: Male of this large (TL=4.0-7.0), rather pale coloured species with heavily built annulated legs is easily recognized by the large conductor supporting the apex of embolus (Fig. 60) and the female by the elliptical atrium with shallow grooves leading to the entrance holes (Fig. 62).

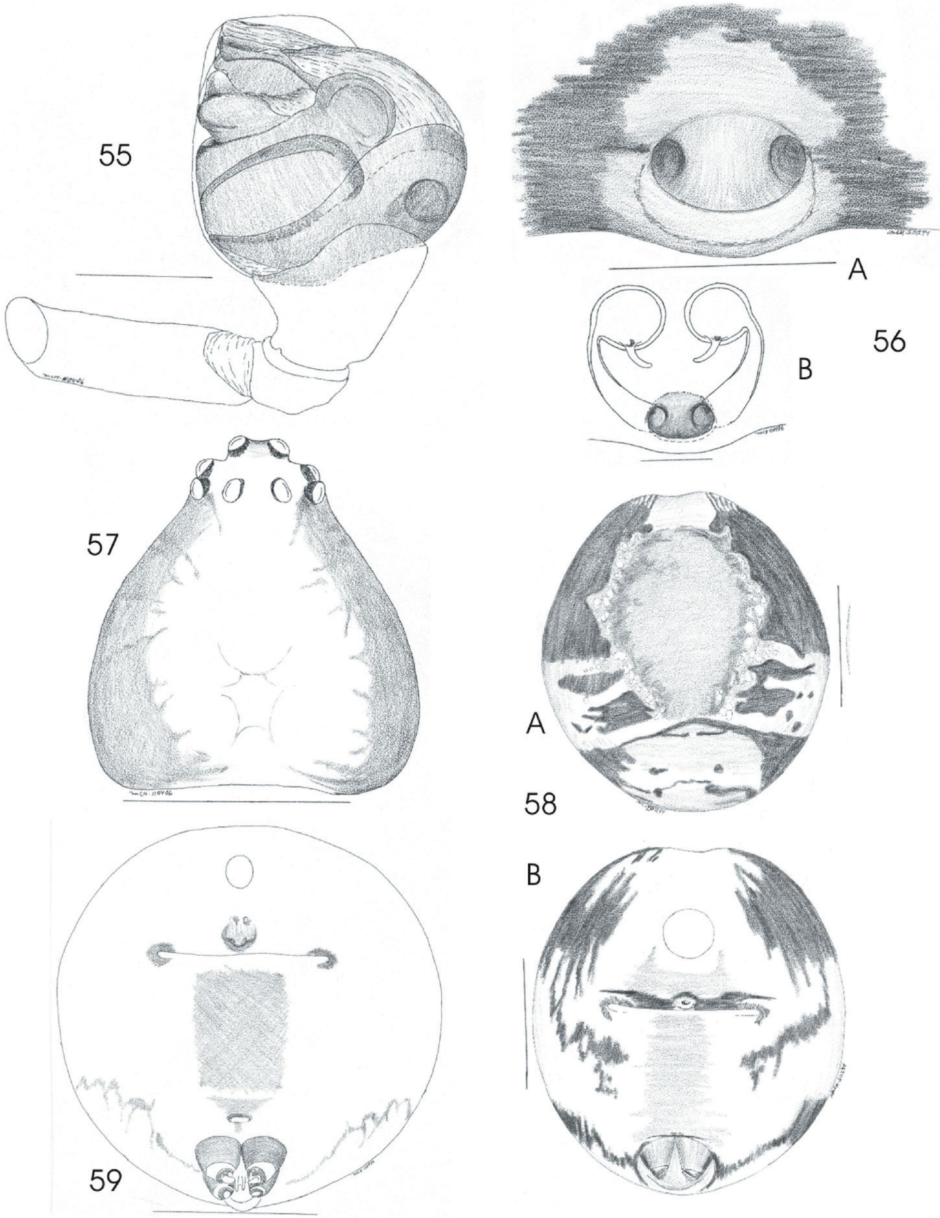
Description: The species has been well described by Locket & Millidge (1953).

Distribution: This is a cosmopolitan species associated with man. It has been once reported from the Seychelles, viz. from Mahé (Simon 1898).

Genus *Robertia* n. gen.

Type species: Theridion braueri Simon, 1898 from Seychelles.

Diagnosis: Male palp with voluminious somewhat cone-like conductor that has its edges slightly over lapping each other and enclosing the distal half of the simple whip-like embolic. Female epigyne with a relatively large tongue-like postiorly ponting median extension, openings of the entrance duct inside two shallow depressions immidiatelly anteriorly from the extension.



Figs. 55-59. *Parasteatoda mudula* (L. Koch, 1872). – 55: Male palp laterally (Papua). – 56: Epigyne (A) and adnexae (B) ventrally (Seychelles). – 57: Female carapace dorsally (Seychelles). – 58: Abdomen of female dorsally (A) and ventrally (B) (Seychelles). – 59: Abdomen of female ventrally (Papua). – Scale bars: Figs 55, 56 = 0.2 mm, Figs 57-59 = 1.0 mm. – Orig.

Etymology: The generic epithet is derived from the surname of Dr. Michael Roberts who has described several theritiids both from the granitic Seychelles and Aldabra. Gender feminine.

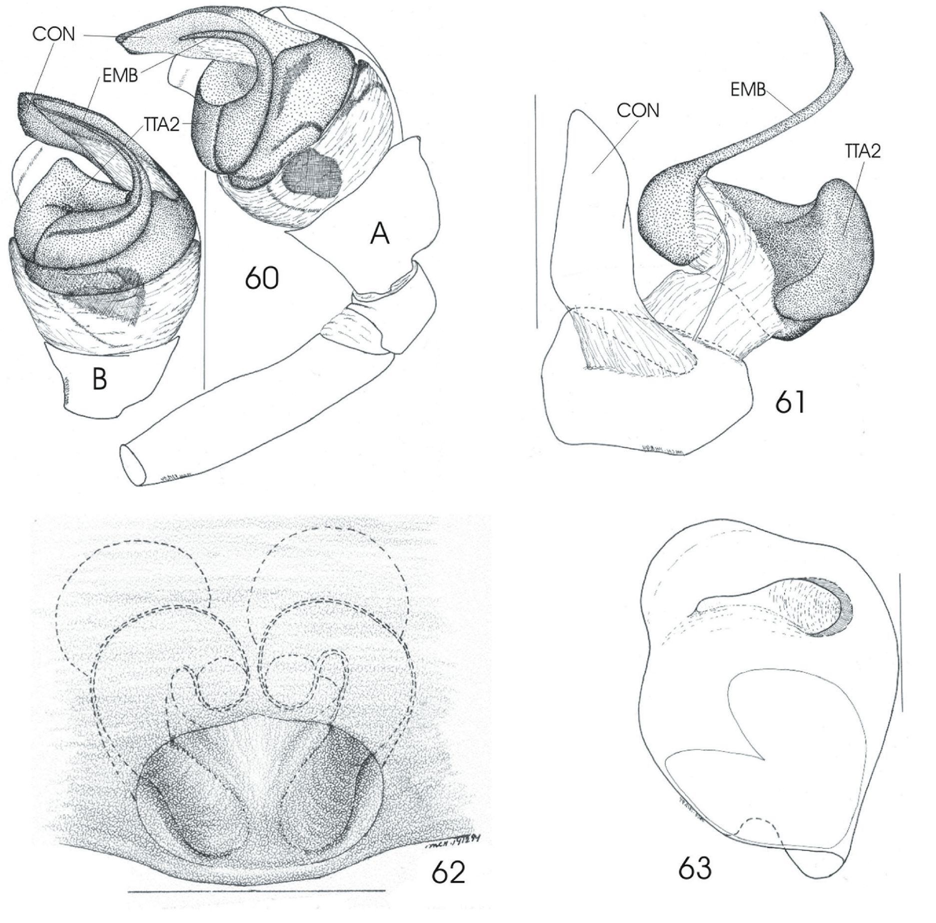
Robertia braueri (Simon, 1898). **n. comb. (**Figs. 64-66)

Theridion braueri Simon, 1898d: 377, f. 1-2 (Dm).

Theridion purifum Roberts, 1978: 909, f. 15-19 (Df).

Theridion braueri, Saaristo 1999: 3 (= *purifum*).

Specimens examined: Mahé, Morne (330-390m elev.), 3##1$, 04.01.1958, W.D. Hartman leg. and various places, 1#7$$1subad.$2juvs 01-02.01.1999, M. Saaristo, P. Matyot and M. Kirkpatrick leg. (MZT AA 0.916-0.919); Silhouette, *Pisonia* forest 2$$



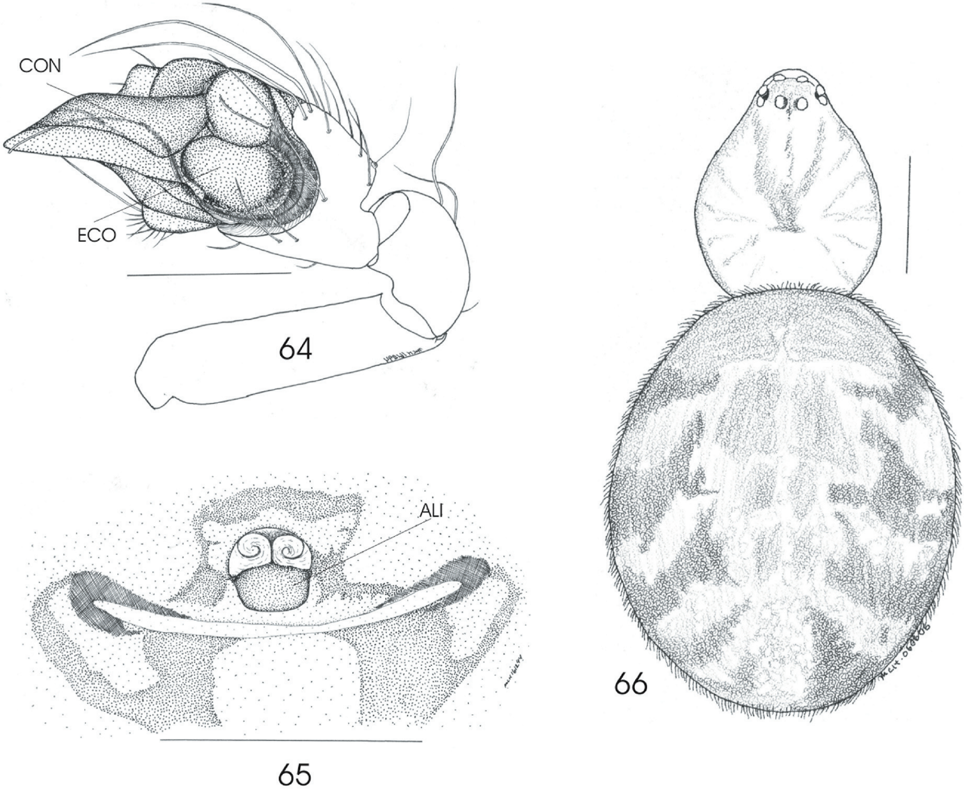
Figs. 60-63. *Parasteatoda tepidarioria* (C. L. Koch, 1841). – 60: Male palp ventrally (A) and anteroventrally (B). – 61: Apical part of bulbus treated with KOH dorsally. - 62: Epigyne and adnexae ventrally. - 63: Cymbium ventrally.– Scale bars: Figs. 60-62 = 0.5 mm, Fig. 63 = 0. 2mm. – Orig.

1juv., 1990, J. Gerlach leg. (MZT AA 0.221), Chemin Montagne Posee, 6##6$$, 09.01.1999, M. Saaristo and J. Gerlach leg. (MZT AA 0.911-0.913), and Jardin Marron, 4$$, 20.01.1999, M. Saaristo and J. Gerlach leg. (MZT AA 0.914 and 0.915).

Diagnosis: The male is easily recognised by the large, frontally pointing conductor (Fig. 64) and the female by the large swollen atrial lingua (Fig. 66).

Description: Female well described by Roberts (1973). Male quite similar but smaller and brighter coloured.

Discussion: Roberts (1978: 913) originally intented to describe his *purifum* in *Nesticodes* as he considered it to be close to the type species of that genus, viz. *Theridion rufipes* Lucas, 1846. After consulting the case with Prof. H.W. Levi he agreed that both species were best left in *Theridion*. In my mind neither of these two species are congeric with the type species of *Theridion*, viz. *Theridion pictum* (Walckenaer, 1802) nor are they conspecific with each other.



Figs. 64-66. *Robertia braueri* (Simon, 1898). – 64: Male palp laterally.– 65: Epigyne ventrally. – 66: Female dorsally. – Scale bars: Figs 64, 65 = 0.2 mm, Fig. 66 = 1.0 mm. – Orig.

Distribution: This is again another endemic species found on Mahé (Simon 1898, Roberts 1978: *Theridion purifum*, Saaristo 1999) and Silhouette (Saaristo 1999).

Genus *Selimus* n. gen.

Type species: Theridion placens Blackwall, 1877 from Seychelles.

Diagnosis: The genus is characterised by the complicated embolic complex bearing a thin spike-like embolus; also other tegular scleites more complicated as usual (Figs. 67-70). Epigyneal atrium very shallow roughly tringular, pointing posteriorly and bearing several transverse wrinkles (Fig. 71).

Discussion: While revising the genus *Anelosimus* Levi (1956a) transferred to this otherwise American genus also three European species; viz. *Theridion vittatus* C. L. Koch, 1836, *Theridion pulchellus* Walckenaer, 1836, and *Theridion aulicum* (C. L. Koch, 1838). As the male palp of the two first mentioned species and *Theridion placens* Blackwall, 1877 are very similar I (Saaristo 1978) transferred also it into *Anelosimus* though I at the same time doubt if these three species were congeneric with the type species of the genus, viz. *A. eximius* (Keyserling, 1884). Comparisons of the copulatory organs of *A. eximius* with *A. placens* have revealed that they are so different that *A. placens* can not be considered as congeneric with *A. eximius*. Therefore a new genus *Selimus* **n. gen.** is created including the following species: *Selimus placens* (Blackwall, 1877) **n. comb.**, and *Selimus locketi* (Roberts, 1983) **n. comb.**

Figs. 67-76.

Selimus placens (Blackwall, 1877) **n. comb.** (Figs. 67-76)

Theridion placens Blackwall, 1877: 13, pl. 2, f. 10 (Dmf).

Anelosimus placens, Saaristo 1978: 118, f. 192-202 (Tmf from *Theridion*).

-*"-,* Roberts 1978: 918, f. 31-34 (mf).-"-, Roberts 1983: 240, f. 95-96 (f).

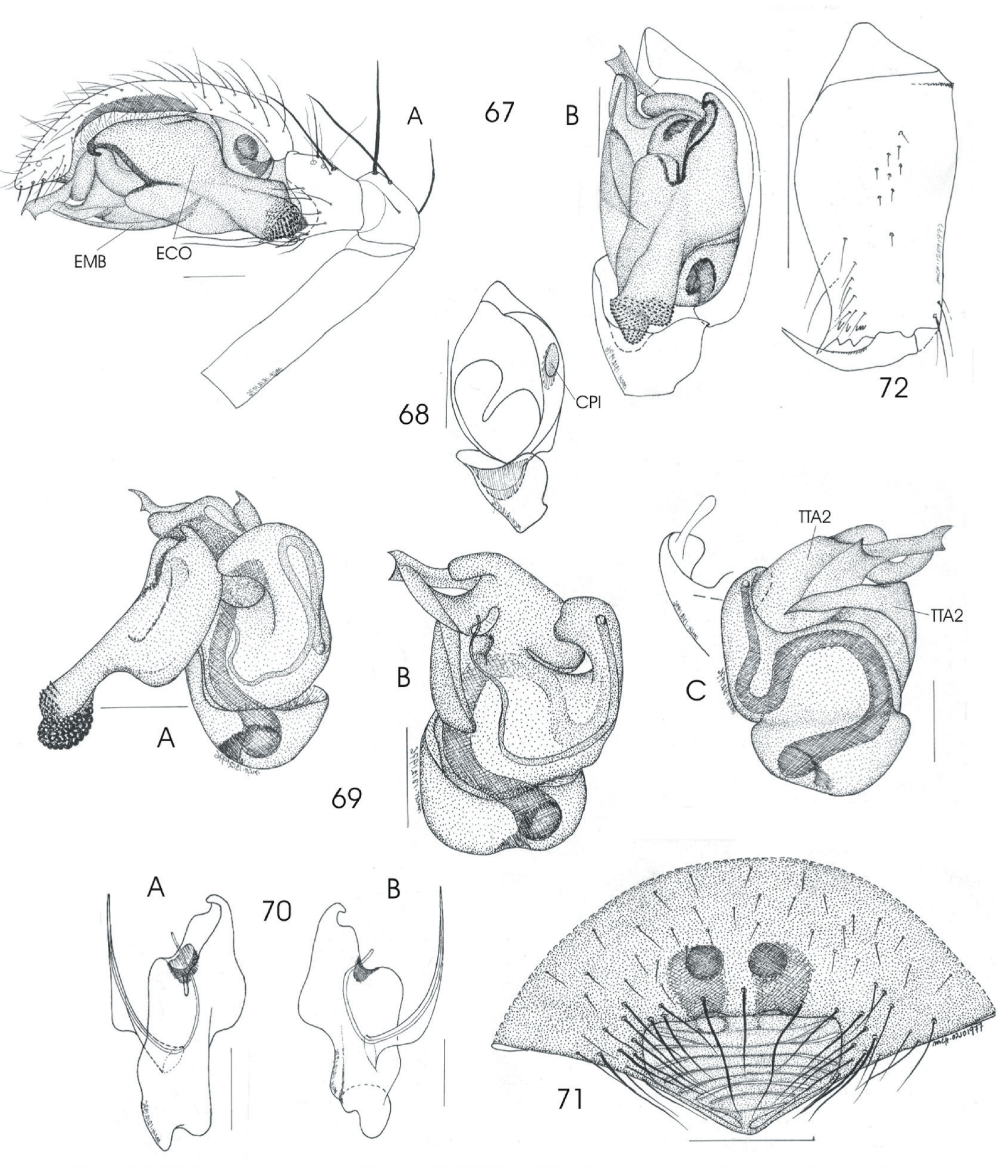
Specimens examined: Aride, 1#1juv., 1975, M. Mühlenberg leg. (MZT AA 0.222); Mahé: golf green of the Reef Hotel, 3##7$$, 24.10.1975, M. Saaristo leg. (MZT AA 0.038); Silhouette: La Passe, 3##14$$2juvs, 13-15.01.1999, M. Saaristo and J. Gerlach leg. (MZT AA 0.897-0.899), between Anse Lascars and Anse Patates, 1f2j., 12.01.1999, M. Saaristo and J. Gerlach leg. (MZT AA 0.900), Jard. Marron, 1$, Dec. 1993, J. Gerlach leg. (MZT AA 0.901).

Comparative specimens examined: Anelosimus eximius: FRENCH GUIANA: Cayenne Prov., Montagnes Kaw, nr. Camp Calman, ca 27 km SE Roura, 4.33N 52.09W, el. 100-300 m, 2##2$$, 8.VIII.1988, S. Marshall leg. (MZT AA 3.712). VENEZUELA, 1#6$$18juvs, 10.XII.1975, M. Stejskal leg (MZT AA 3.713 and 3.714)

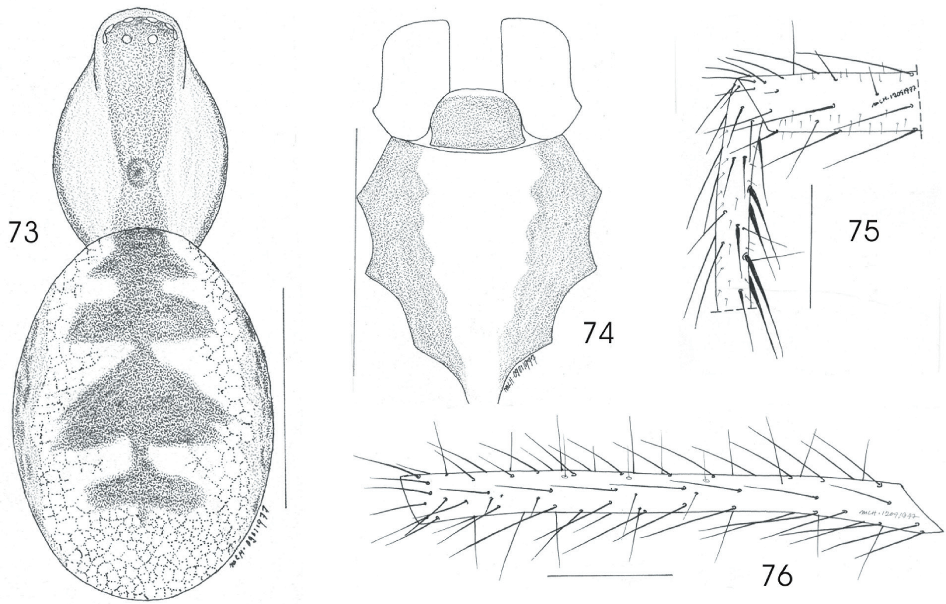
Diagnosis: This fairly large species is easily reconized by having on the dorsal side of the somewhat elongated abdomen a median blackish spruce-like band on white back ground (Fig. 73).

Description: Well described by Saaristo (1978) and Roberts (1978).

Distribution: This endemic species has been found on the following islands: Aride (Bowler *et al*. 1999), Curieuse (Roberts 1978), Mahé (Saaristo 1978, Roberts 1978), Praslin (Roberts 1978) and Silhouette (Saaristo 1999).



Figs. 67-72. *Selimus placens (*Blackwall 1887). – 67: Male palp laterally (A) and ventrally (B). – 68: Cymbium ventrally. – 69: Bulbus treated with KOH dorsolaterally (A), and with embolic part removed dorsally (B) and ventrally (C). – 70: Embolic complex dorsally (A) and ventrally (B). – 71: Epigyne ventrally. – 72: Male chelicher from behind. – Scale bars: Figs. 66-71 = 0.2 mm, Fig. 72 = 0.5 mm. – Orig.



Figs. 73-76. *Selimus placens (*Blackwall 1887). – 73: Female dorsally. – 74: Female Maxillae, labium and sternum ventrally. – 75: Tip of tibia and proximal part of metarsus of male leg I laterally. – 76: Lateral view of female TiI. – Scale bars = 0.5 mm. – Orig.

Genus *Sesato* n. gen.

Type species: Sesato setosa **n. sp.**

Diagnosis: This monotypic genus is characterized by the outstanding, spindle-like terminal apophysis exceptionally large cymbial pit. Also the long medially directed spines on ventral side of male femur I may be diagnostic. Epigyneal atrium very small, circular and shallow.

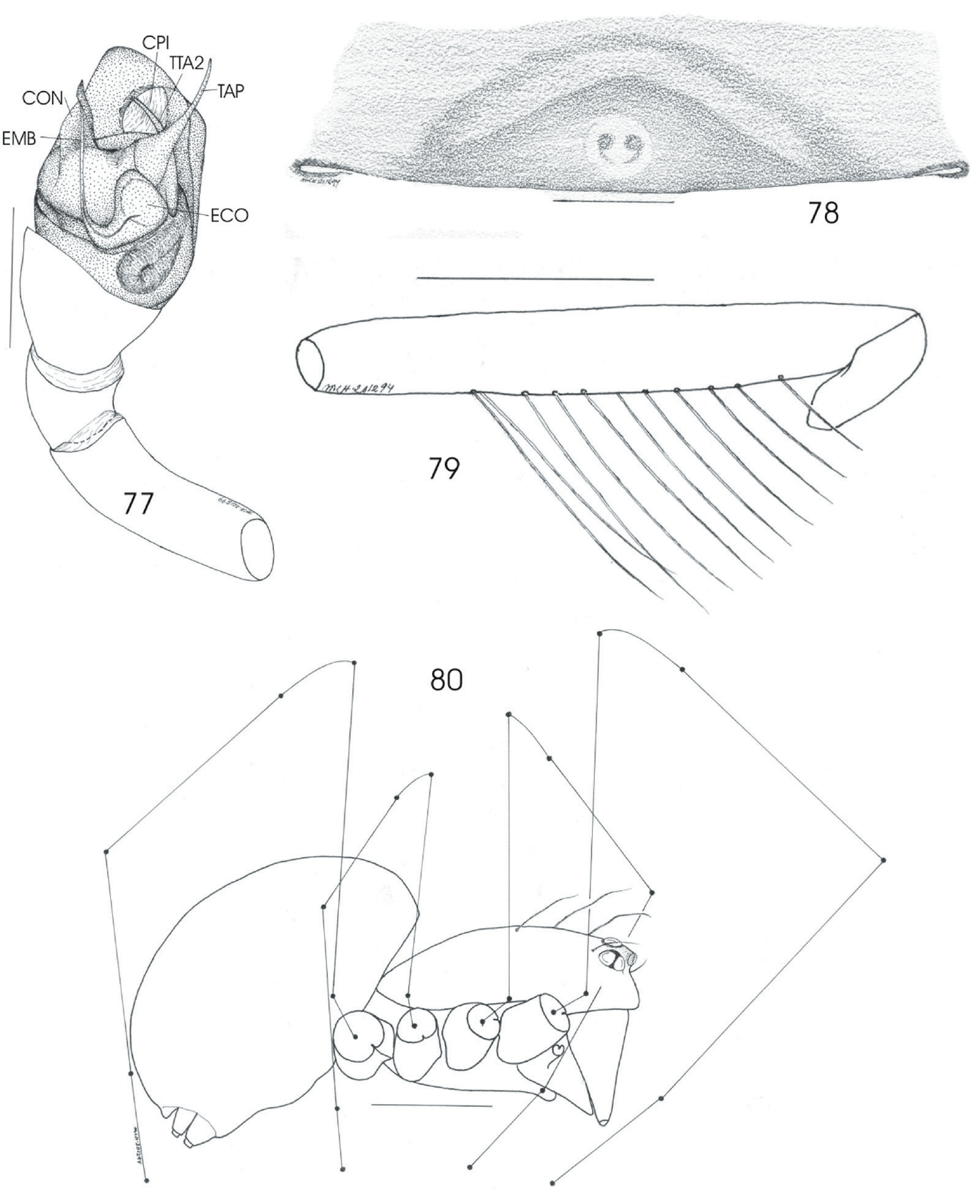
***Sesato setosa* n. sp. (**Figs. 77-80)

N. gen., n. sp., Gerlach *et al*. 1997

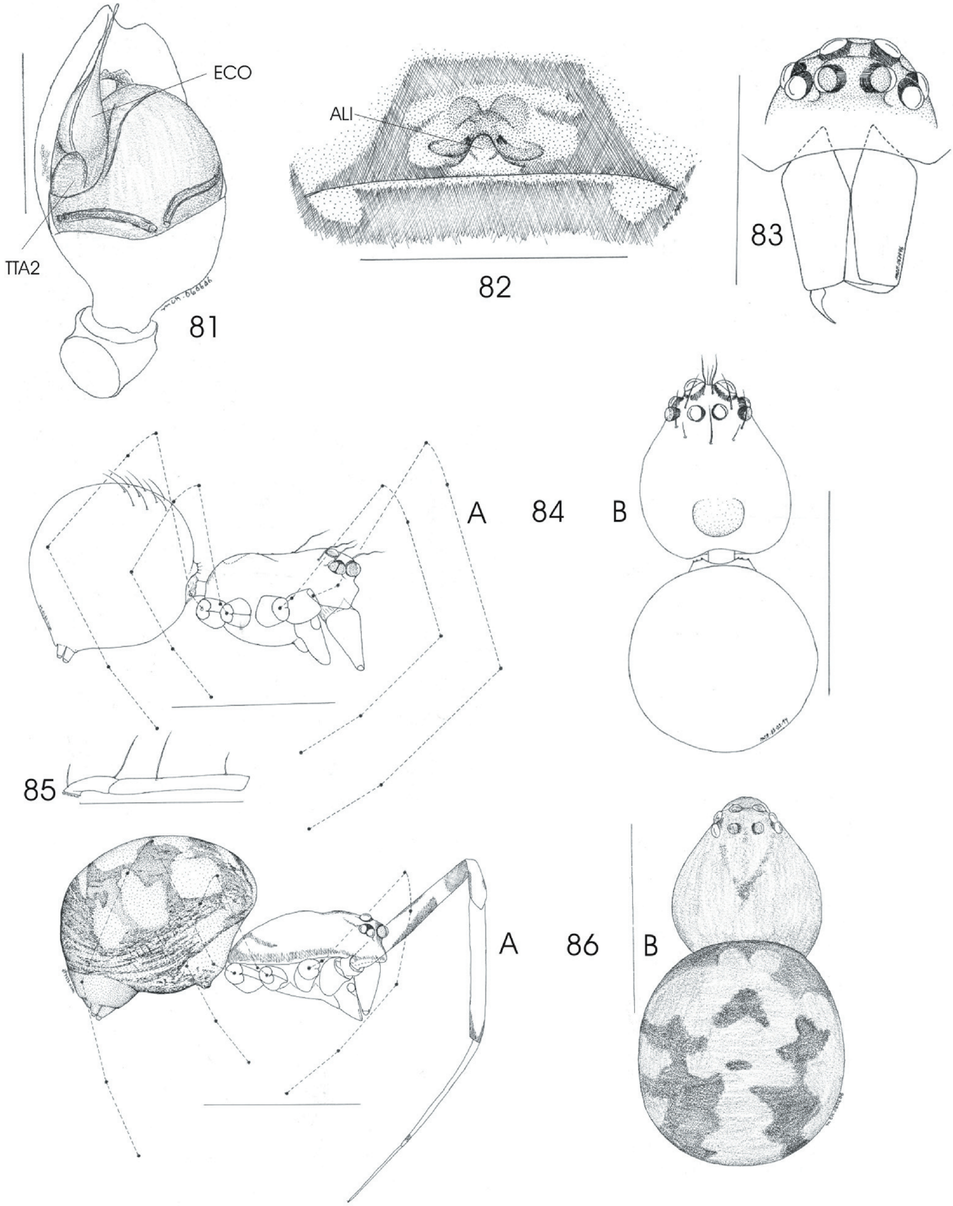
Genus ign., G. sp. ign., Saaristo 1999

Types: Holotype male and allotype female from Silhouette, *Pisonia* forest, 1990, Justin Gerlach leg. (MZT AA 0.223/T5). Paratypes: La Passe, 4##4$$, 21.01.1999, M. Saaristo leg. (MZT AA 0.902), La Passe, 1$, 11.01.1999, M. Saaristo leg. (MZT AA 0.903), La Passe, 1#, 12.01.1999, M. Saaristo leg. (MZT AA 0.904), and Anse Lascars, 1$, 12.01.1999, M. Saaristo leg. (MZT AA 0.905).

Diagnosis: The male of this rather dull coloured species is easily recognised by the row of long thin apically pointing macrosetae on the ventral side of femur I (Fig. 79). The female may be distinguished by the pale median circular area enclosing a pair of dark, comma-like figures (Fig. 78).



Figs. 77-80. *Sesato setosa* n. sp. - 77: Male palp ventrally. – 78: Epigyne ventrally. – 79: Fel of male mesially. – 80: Female laterally. – Scale bars: Figs 77, 78 = 0.2 mm, 79, 80 = 0.5 mm. – Orig.



Figs. 81-86. *Spinembolia clabnum* (Roberts, 1978). – 81: Male palp laterally. – 82. Epigyne ventrally. – 83: Male carapace frontally. – 84: Male laterally (A) and dorsally (B). – 85: Patella and TiI of male. – 86: Female laterally (A) and dorsally (B). – Scale bars: Fig. 81 = 0.2 mm, Figs 82, 83 = 0.5 mm, Figs 84.86 = 1.0 mm. – Orig.

Description: This is a mediun sized species (TL=1.65-1.86, CL=0.78-0.98). Carapace yellow-brown with a darker area behind the eyes, a few dark streaks radiating from that area toward with black suffused edges. Legs light ferruginous; all segments except tarsi suffused with black especially at apices. Chelicerae, maxillae, labium and sternum brown suffused with black. Abdomen blackish. Carapace fairly flat, abdomen globose, relative sparsely clothed with fairly long, curved hairs; on well elevated bases. Eyes moderate large, more or less equal in size. Chelicerae with two teeth, median one with small subtooth. No colulus. Male withdorsal stridulatory organ and long medially directed spines on ventral side of femur I. Male palp with all four tegular sclerites (Fig. 77).

Female (Fig. 80) much like male but slightle larger. Epigyneal atrium conspicuosly small and shallow with apair of dark, comma-like figures.

Distribution: This may be an endemic species and so far found only on Silhouette.

Genus *Spinembolia* n. gen.

Type species: Theridion clabnum Roberts, 1978 from Seychelles.

Etymology: Generic epithet refers to the spine-like apical part of the embolic complex. Gender feminine.

Diagnosis: This monotypic genus is characterized by the peculiar embolic complex consistying of a bulbous basal part and spine-like apical part (Fig. 81). Epigyne with a thick, anteriorly anteriorly pointing atrial lingua (Fig. 82)

Spinembolia clabnum (Roberts, 1978) **n. comb. (**Figs. 81-86)

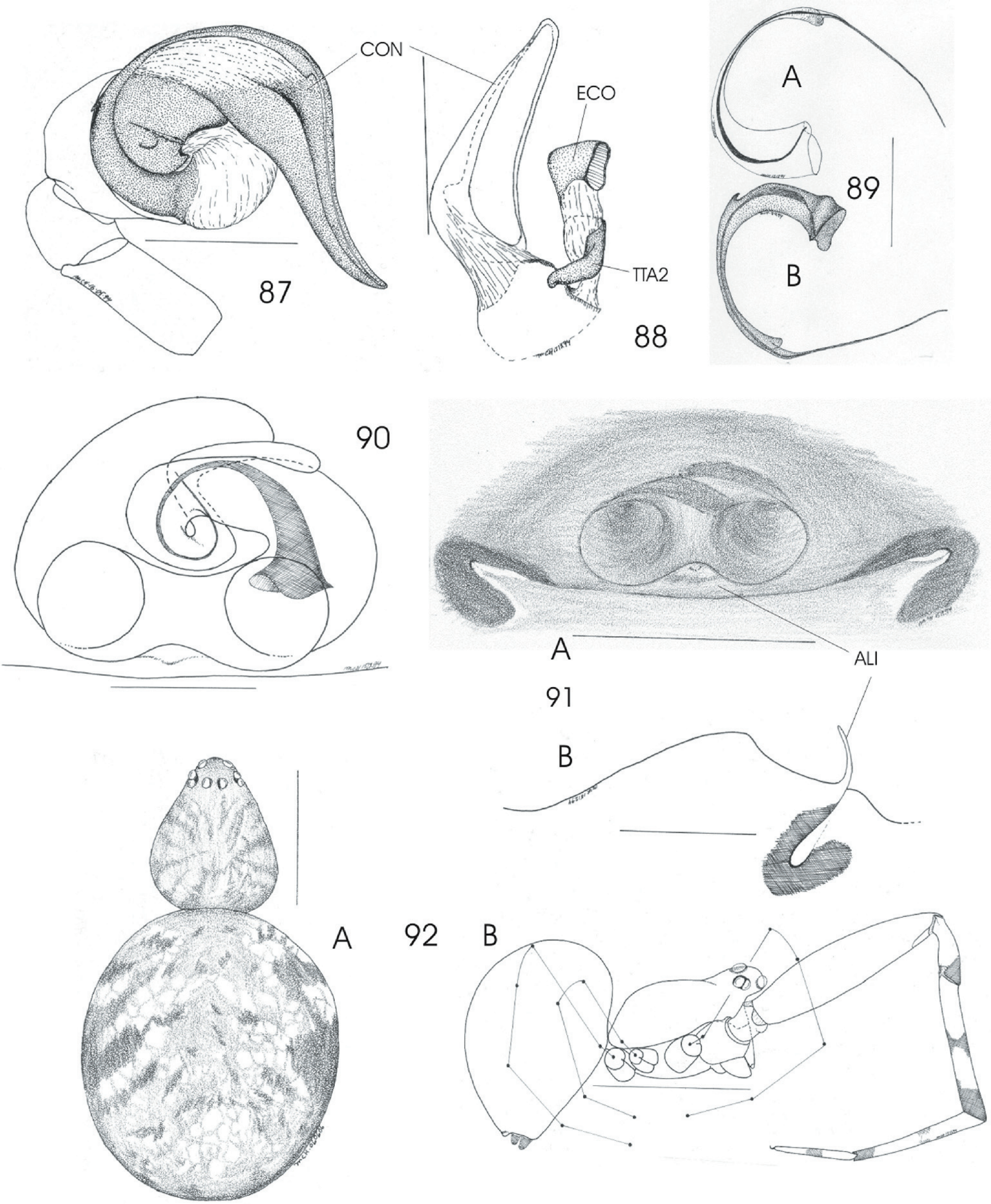
Theridion clabnum Roberts, 1978: 908, f. 10-14 (Df).

Specimens examined: Aride, 1#, 18.08.1975, M. Mühlenberg leg. (MZT AA 0.224 and litter sampling, 1$, July-November 2000, John Bowler leg. (MZT AA 2.138); Conception, pitfall, 1$, 25.09. 1999, coll. BirdLife leg. (MZT AA 1.954); Cousine, 2##11$$22juvs, 25.01.1999, M. Saaristo leg. (MZT AA 0.840 and 0.841); Curieuse, pitfall, 1#, 12.01.2000, coll. BirdLife leg. (MZT AA 1.958); Denis, pitfall, 2$$3juvs, 12.04.2000, coll. BirdLife leg. (MZT AA 1.956-1.957); Felicite, pitfall, 1$, 14.11. 1999, coll. BirdLife leg. (MZT AA 1.955); Grande Soeur, 2##, 17.09.1975, M. Mühlenberg leg. (MRAC 177.100 and 177.124); Mahé, Anse Louis, paratype female of *Theridion clabnum*, June 1972, P.L.G. Benoit & J.J. van Mol leg. (MRAC 143.320) and 7##3$$, 01-02.01.1999, M. Saaristo, P. Matyot and M. Kirkpatrick leg. (MZT AA 0.842-0.845); North, 2##6$$, 30.07.2000, J. Gerlach leg. (MZT AA 1.394) and by pitfalls, 2##2$$2juvs, 1999-2000, coll. BirdLife leg. (MZT AA 1.959-1.964); Praslin, Vallée de Mai, two paratype females of *Theridion clabnum*, July 1972, P.L.G. Benoit & J.J. van Mol leg. (MRAC 150.207); Silhouette, various places, 23##77$$8juvs, 07-23.01.1999, M. Saaristo and J. Gerlach leg. (MZT AA 0.816-0.839) and Belle Vue, (pitfall traps), 1#., 16-20.07.1999, J. Gerlach leg. (MZT AA 1.306), Jardin Marron, 10 pitfalls, 1#1subad.#, 08.07-09.08.2000, J. Gerlach leg. (MZT AA 1.393), Pisonia forest, sweep netting, 1$, 06.07.2000, J. Gerlach leg. (MZT AA 1.395), and Mon Plaisir, *Dracaena reflexa* crown, 1$, 10.07.2000, J. Gerlach leg. (MZT AA 1.396)

Diagnosis: The male is easily recognized by the the peculiar embolic complex consistying of a bulbous basal part and spine-like apical part (Fig. 81) and the female by the blunt-tipped light coloured anteriorly pointing atrial lingua immidiatelly before the epigastric furrow (Fig. 82).
Description: This is a medium sized species (TL=1.6-2.0, CL=0.74-0.76), length of carapace in both sexes about the same but gravid females somewhat larger than males. Carapace and sternum pale yellow suffused with black; chelicerae, maxillae and labium yellow-brown; legs and palpi pale yellow; dorsal abdominal colour pattern distinct similar in both sexes see fig. All patellae and tibiae with two dorsal spines; longest in tibia I (Fig. 85). Clypeys fairly high, slightly protruding medially in male (Fig. 84A). Chelicerae toothless; eyes relatively large, all about the same size (Fig. 83). Fovea notably large, very shallow, almost circular (Fig. 84B). Petiolar stridulatory organ present in male. Abdomen globular with distinct colour pattern (Fig. 86). No colulus. Tegular sclerites much simplified
Distribution: This possibly endemic species has been found on Aride (Bowler *et al.* 1999), Conception (Saaristo & Hill 2002), Cousine (Saaristo 1999), Curieuse (Saaristo & Hill 2002), Denis (Saaristo & Hill 2002), Felicite (Saaristo & Hill 2002), Grande Soeur, La Digue (Roberts 1978), Mahé (Roberts 1978), North (Saaristo & Hill 2002), Praslin (Roberts 1978) and Silhouette (Saaristo 1999).

Genus *Stoda* n. gen.
Type species: Theridion libudum Roberts, 1978 from Seychelles.
Diagnosis: Male palpus of the same simplified type as in *Parasteatoda*. It differs in having a special breaking point for the embolus. Bases of embolic complex and tegular apophysis connected by a membrane with each other and with a common membrane to tegulum; conductor considerably large (Figs 87-89).
Discussion: It is quite obvious that the breaking of embolus prevents additional pairing. The phenomen is not uncommen among spiders. During copulation the embolus is cut loose at the breaking point and left inside the vulva (Fig.90). In a sample of 14 females all individuals had the embolus inside both halves of the vulva.

Stoda libudum (Roberts, 1978) **n. comb**. (Figs. 87-92)
Theridion libudum Roberts, 1978: 905, f. 5-9 (Df).
Specimens examined: Mahé: 3##11$$, 01. and 02.01.1999, M. Saaristo, P. Matyot and M. Kirkpatrick leg. (MZT AA 0.813-0.815); Silhouette, sweep netting *Pisonia*, 3##16$$1juv., 1990, J. Gerlach leg. (MZT AA 0.217-0.220) and Chemin Montagne Posee, 1subad.#6$$, 09.01.1999, M. Saaristo and J. Gerlach leg. (MZT AA 0.808-0.810), Jardin Marron, 2$$, 13. and 20.01.1999, M. Saaristo and J. Gerlach leg. (MZT AA 0.811-0.812); North, marsh edge, *Heliotropium* sweep netting, 1f2juvs., 30.07.2000, J. Gerlach leg. (MZT AA 1.397).
Diagnosis: The male is easily recognised by the large, grooved beak-like conductor and the female by oval shaped atrium with a thin atrial lingua and large openings on the entrance ducts (Figs 90 and 91).



Figs. 87-92. *Stoda libudum* (Roberts, 1978). – 87: Male palp laterally. – 88: Apex of bulbus treated with KOH and embolus removed. – 89: Embolus dorsally (A) and ventrally (B). 90: Adnexae dorsally with embols inside.– 91: Epigyne dorsally (A) and laterally (B). – 92: Female dorsally (A) and male laterally (B). – Scale bars: 87-91 = 0.2 mm, Fig. 92 = 1.0 mm. – Orig.

Description: Total length: m=1.80mm, f=3.75mm; length of carapace: m=0.96mm; 1.51mm; male decidedly smaller than female, dward-like compared with gravid female. Male carapace yellowish brown, heavily suffused with black that of femele dark brown. Chelicerae, maxillae, labium and sternum yellow – pale brown, more or less suffused with black. Legs pale yellow annulated with grey-black; metatarsi and tarsi more orange in colour. Abdomen with a complicated pattern of dirty white and black stripes and patches; here and there on dirty white areas snow white guanine corpuscles; in addition females with reddish/reddish-brown area dorsally. Abdomen rather densely clothed with fairly long curved hairs standing on small well chitinized basal plates. Ocular area of male strongly projecting forward, that of female only slightly (Fig. 92). Fovea roundish, very shallow. Legs thick and robust; first legs much bigger than the others. Male abdomen long ovoid, that of female more globular. Chelicerae with two teeth on anterior margin. No colulus present.
Distribution: This endemic species has been found on Mahé (Roberts 1978, Saaristo 1999 as *Theridion libudum*), Silhouette (Roberts 1978, Saaristo 1999 *Theridion libudum*) and North.
Discussion: Roberts (1978) placed this species with some hesitation in *Theridion* because he had only females in his disposal. Discovery of males have made it possible to asses that it is not congeneric with the type species of *Theridion*, viz. *Theridion pictum* (Walckenaer, 1802), but fairly close to *Parasteatoda*. However, a new genus is created to emphasise the peculiar mode of breaking the embolus during copulation to plug the entrance tube of the female epigyne.

Genus *Theridion* Walckenaer, 1805
Theridion Walckenaer, 1805: 72. - Type species designated by Int. Comm. Zool. Nomencl., Opinion 517, 1958 as *Aranea picta* Walckenaer, 1802 from Europe.
Diagnosis: Male with a ventral, posteriorly thickening swelling epigastric area (Fig. 96, arrow). Base of embolic complex roughly circular disc with a small crooked basal extension, embolus proper long, filiform. Entrance openings of epigyne inside a spherical or oval atrium.

Theridion melanostictum O. P.-Cambridge, 1876 (Figs. 93-96)

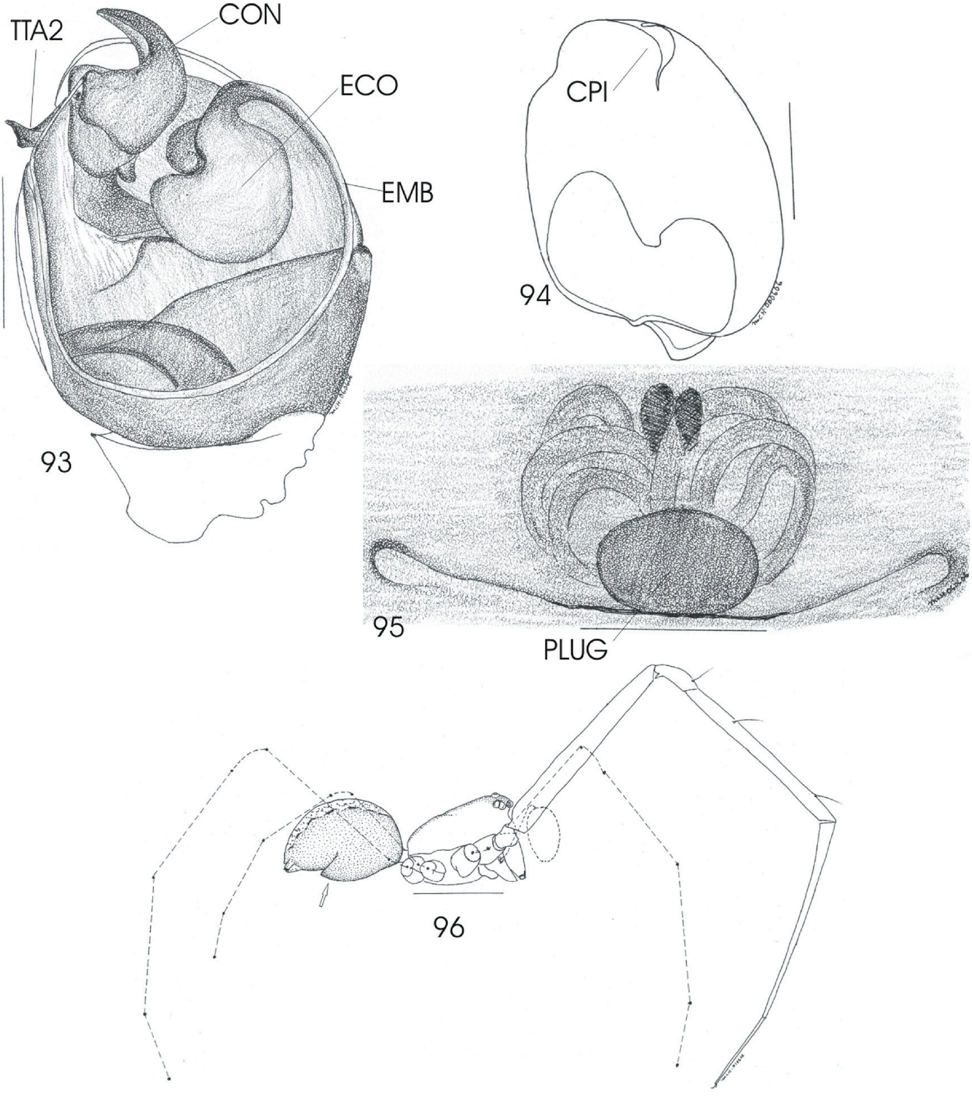
Theridion melanostictum O. P.-Cambridge, 1876b: 570 (Df).
Theridion scorinum Roberts, 1983: 233, f. 66-74 (Dmf).
Theridion melanostictum, Levy & Amitai 1982: 99, f. 32-37 (mf).
-*”-,* Yoshida, 2003a: 75, f. 178-181 (mf = *scorinum*).

N.B. For more references see Platnick 2006.
Specimens studied: Cousine, in house, 1$, 23.07.1995, O. Bourquin leg. (MZT AA 2.144); Silhouette, La Passe, 1#8$$, 11-15.01.1999, M. Saaristo & J. Gerlach leg. (MZT AA 0.906.-0.909).
Diagnosis: The male is easily recognised by its volumnious palp with finger-like pointing basal part of the tegular apophysis and the large beak-like conductor (Fig. 93) and the female by the usually pluged epigyne, long coiled entrance tubes and black

coloured elongated receptaculae (Fig. 95).

Description: Well described e.g. by Levy & Amitai (1982) and Roberts (1983 as *Theridion scorinum*).

Distribution: This is a widely distributed found from Mediterranean, Aldabra, China, Japan, USA, Hispaniola (Platnick 2005). On the granitic Seychelles islands found on Cousine and Silhouette (Saaristo 1999 as *Theridion scorinum*).



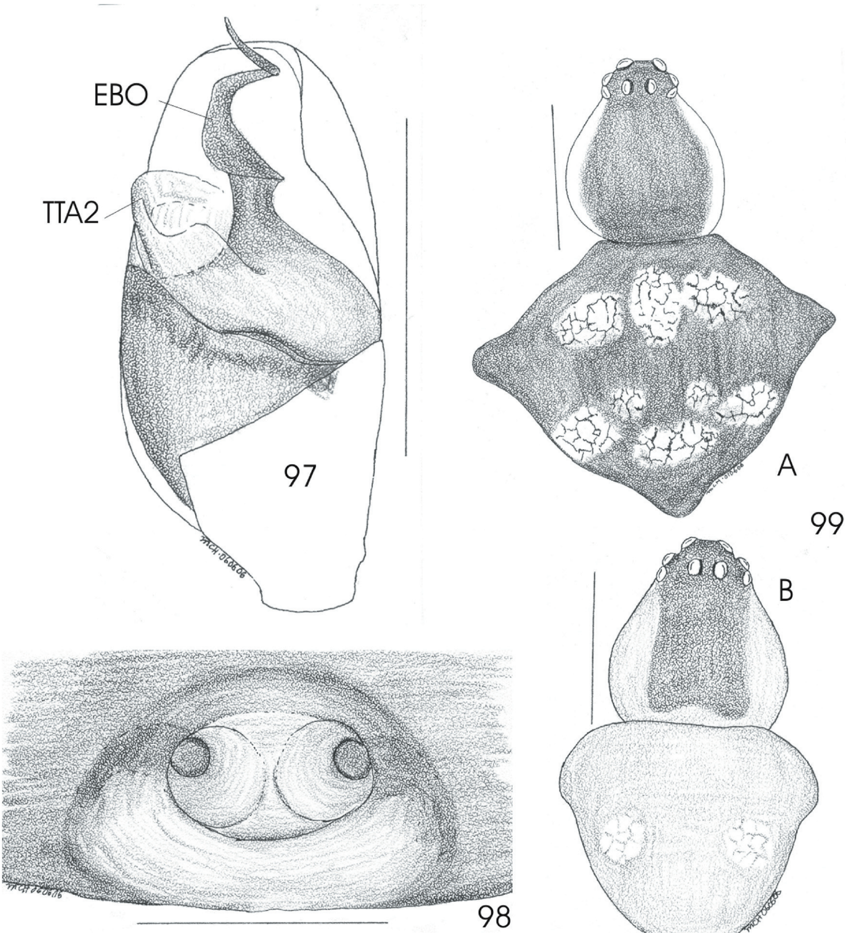
Figs. 93-96 *Theridion melanostictum* O. P.-Cambridge, 1876. – 93: Male palp laterally. – 94: Cymbium ventrally. – 95: Epigyne ventrally lightly treated with KOH. – 96: Male laterally. – Scale bars: 93-95 = 0.2 mm, 96 = 1.0 mm. – Orig.

subfamily Theridulinae Archer, 1950

Diagnosis: Tegular sclerites much reduced consisting only of the embolic complex and the theridiid terminal apophysis which has been modified to a membranous tube firmly attached to a circular area on the inner side of the cymbium (Fig. 97).

Gen. *Theridula* Emerton, 1882

Theridula Emerton, 1882: 25. - Type species by subsequent designation (Simon 1894: 545) *Theridion sphaerula* Henz, 1850 from USA = *Theridion opulentum* Walckenaer, 1841 from USA (Simon 1894: 545).



Figs. 97-99. *Theridula gonygaster* (Simon, 1881). - 97: Male palp ventrallyally. – 98: Epigyne ventrally. - 99: Female dorsally from Cousin (A) and Aldabra (B). – Scale bars: 97, 98 = 0.2 mm, 99 = 0.5 mm. – Orig.

Theridula gonygaster (Simon, 1881) (Figs. 97-99)

Theridion gonygaster Simon, 1873a: 292, pl. 2, f. 24 (Dmf).

-"-, Levi 1967c: 176, f. 5-8 (mf).

-"-, Brignoli 1969: 262, f. 2-3, 6 (f).

-"-, Roberts 1983: 227, f. 36-37 (mf).

-"-, Chikuni 1989: 40, f. 50 (f).

-"-, Zhu 1998: 75, f. 43A-D (mf).

-"-, Song Zhu & Chen, 1999: 148, f. 83H-J (mf).

-"-, Melic 2000: 49, f. 1-4 (f).

N.B. For more references see Platnick 2005.

Specimens examined: Aldabra, Pickard, 3##3$$, 1974-1975, R. Prys-Jones leg. (MZT AA 2.475), Cousin, swept from Rangoon creeper, 1$1juv., 12.04.1978, Hugh Watkins leg. (MZT AA 0.226).

Diagnosis: This small species (TL=1.7-2.5mm) is usually easily recognized by its pale colouration contrasted by the wide dark band on dorsal side of the carapace (Fig. 99A). However there seem to be two colour morphs of females as in addition to the pale form there is a very dark form which also usually have the lateral and posterior sides of the abdomen characteristically bulged (Fig. 99A). Also the copulatory organs are distinct (Figs. 97 and 98).

Description: Well described by Levi (1954, 1967).

Distribution: This is a pantropical species (Platnick 2006) which is new to the granitic Seychelles islands. So far found only on Cousin and from Aldabra (Roberts 1983).

Acknowledgements

I am greatly indebted to Dr. R. Jocqué, Musée Royal de l'Afrique Centrale, Tervuren (MRAC) and his family for their hospitality during my research visit in Tervuren. Many thanks are also due to the following persons who kindly helped me during my visit to Seychelles in 1999: Dr. Justin Gerlach, Mr. and Mrs Ron and Gill Gerlach, Mr. Pat Matyot, Dr. Maureen Kirkpatrick, Mr. Peter Hitchins and Mrs. Stella Hitchins. I am grateful for the large and important spider collection sent to me and collected by Dr. Michael Hill and colleagues as part of the project Management of Avian Ecosystems in the Seychelles. It is also my pleasure to thank the following persons for interesting and valuable spider samples from Seychelles: Dr. J. Gerlach, Dr. J. Bowler, Mr. P. Matyot and Mrs. S. Hitchins.

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Phelsuma **13**; 90-92

Status of *Zonosaurus madagascariensis insularis* on Cosmoledo atoll

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Abstract. - The status of the Malagasy girdled lizard *Zonosaurus madagascariensis insulanus* on Cosmoledo atoll, Seychelles is assessed. It is recorded from three islands on the atoll although it is assumed to be present on all islands. The whole atoll population is estimated 4,260±154 individuals. As this subspecies is restricted to low lying islands (Cosmoledo atoll and Grande Glorieuse island) it is considered to be Vulnerable to sea-level rise.

Key words. - Seychelles, Gerrhosauridae, Reptilia, population, status

Introduction

The Malagasy girdled lizard *Zonosaurus madagascariensis* (Gray, 1841) is widely distributed in northern and western Madagascar. It is the only member of the family Gerrhosauridae to occur on the coral islands of the Western Indian Ocean, being recorded from the Gloreuses islands and from Cosmoledo atoll, Seychelles. These populations are described as a distinct subspecies *Z. madagascarienis insulanus* Brygoo, 1985. The population on Grande Glorieuse is reported to be "quite common" (Le Corre, quoted in Matyot 2003). There is little published data on the Cosmoledo population, it was first reported in 1907 when a specimen was collected from the "north-east islands" (Boulenger 1911; Fryer 1911; Matyot 2003). Further sightings were made on Menai in 1937 (by Vesey Fitzgerald, listed in Matyot 2003), 1981 (A.S. Gardner pers. comm.) and 2002 (Matyot 2003). Population estimates were made in December 2005 on several islands of the Cosmoledo group.

Methods & Results

Four islands (Menai, North, North-East and Grande Ile) were visited on the 17-18th December 2005. Only 1-2 hours were spent ashore on each island. As much of the island as possible was searched and a record was kept of the number of lizards observed 1m either side of the observer and their location. The distance covered (subsequently determined from maps) provided a density estimate for that island. Dividing the area surveyed into 100m sections provided replicated areas for error estimation.

Girdled lizards were located on Menai, North and Grande Ile. Survey results are shown in Table 1.

Table 1 Girdled lizard numbers on Cosmoledo atoll

Island	Time of day	Area searched (m^2)	Number observed	Density estimate (per hectare)
Menai	6:30-8:30	1200	1	8.333±3.4
North	10:30-12:00	1200	1	8.333±3.4
North-East	10:00-12:00	1200	0	<8.333
Grande Ile	15:00-17:00	2032	2	9.843±2.077
overall				9.025±0.327

Table 2 Population estimated of girdled lizards on Cosmoledo. The area used for Menai is for dry land only, the mangrove area has not been included.

Island	Area	Density estimate (per hectare)	Population estimate
Menai	230*	8.333±3.4	1,917±782
North	21	8.333±3.4	175±71
North-East	c10	<8.333	<83
Grande Ile	192	9.843±2.077	1,890±399
overall	472	9.025±0.327	4,260±154

Fig. 1. *Zonosaurus madagascariensis insulanus* on North island, Cosmoledo

Discussion

A significant population of *Z. madagascariensis insulanus* is present on Cosmoledo, their presence is confirmed on three islands, but they are probably present on all the islands. In 1907 the species may have had a more restricted distribution, as Fryer noted "a lizard, *Zonosaurus madagascariensis*, found on the North-East Islands" (Fryer 1914), implying that it was not abundant on the other islands he visited (Menai, Wizard [=Grande Ile], Polyte and Goëlette). The lizards are currently present in the abandoned coconut plantation and settlement area on Menai and mixed scrub on the other islands.

These habitats are all comparable, being open habitats with sparse bushes and small trees. From the available data it is estimated that the population on Cosmoledo occupies a maximum area of 472 hectares of dry land and numbers 4,260±154 individuals. This is a substantial population for such small islands. As the species occurs in all of the dry habitats of the atoll and coexists in substantial numbers with introduced cat and rat populations it appears to be secure in current conditions. However, the long-term future of the subspecies may not be secure as the two populations (Cosmoledo and Grande Glorieuse) are both on low coral islands threatened by sea-level rise. Stable habitats are restricted to 1-3m above sea level, although Cosmoledo reaches a maximum altitude of 17m (a sand dune on Grande Ile). Long-term sea-level rise would flood these areas. Accordingly *Z. madagascariensis insulanus* should be considered to be Vulnerable (IUCN Red List criterion D2) due to its very restricted range and vulnerability to sea-level rise.

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Matyot, P. 2003 Observations on some reptiles in Seychelles. *Phelsuma* **11**; 80-84

Phelsuma **13**; 93-101

Distances covered and times taken for nesting of hawksbill turtles (*Eretmochelys imbricata*), Cousine Island, Seychelles

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Abstract - Nesting hawksbill turtles and their eggs and young were studied on Cousine Island, Seychelles from 1995–1999. The nesting sequence was examined for information on distances covered and times taken for the process, which was separated into 7 steps. The average time taken for completion of successful nesting was 103.6 minutes, and the average distance covered during the nesting process was 91.8 metres. Emergences by turtles making no attempt to nest covered significantly shorter distances (average 67.1 metres). When only those turtles for which full nesting sequences were recorded were compared, the differences in nesting vs. non-nesting emergences averaged a distance of 88m covered in 100.9 minutes vs. 53m covered in 22.7 minutes.

Key words - Reptilia, Testudines, Cheloniidae, marine turtles, Hawksbill turtles, *Eretmochelys imbricata*, nesting procedure, Seychelles.

INTRODUCTION

The Seychelles inner granitic islands are situated about 930km north of Madagascar and 600 km east of Africa, and lying between 4-5°S and 55-56°E. The hawksbill turtle is listed as critically endangered and the Seychelles host one of the five most important hawksbill turtle populations in the world (Meylan & Donnelly 1999). A considerable amount of work has been completed on aspects of breeding (Brooke & Garnett 1983; Diamond 1976; Frazier 1984; Garnett 1978; Hitchins *et al*. 2003a; Mortimer & Bresson 1994a, 1994b; Wood 1986), migrations and movements (Hitchins *et al*. 2003b; Mortimer & Broderick 1999) and conservation (Mortimer, 1984) - mainly for Cousin Island, or for the Seychelles generally. This paper gives results of some work done on nesting procedure by hawksbill turtles on Cousine Island, Seychelles, carried out between 1995 and 1999. Cousine Island is about 26 hectares and has a sandy turtle nesting beach about 900m long. Although Diamond (1976) indicated that the total nesting process took an average of 147 minutes for hawksbills (n=5) on the adjacent Cousin Island, and provided some indication of duration of some nesting stages, no detailed work on analyzing the time taken and distance covered for the nesting process by hawksbills has been previously undertaken in the Seychelles, and there appears to be very little detailed information on this process for hawksbills elsewhere.

METHODS

Patrols - Patrols were undertaken daily from August to April at 1-1.5 hour intervals whenever possible, normally between 0600 and 1830, sometimes earlier and later during nesting peaks.

Tagging - Untagged turtles were tagged, either while laying eggs, or while returning to the sea. Non-nesting turtles were tagged only while returning to the sea. Tags were positioned between the first and second large scales on the trailing proximal edge of each fore-flipper, or on the scales themselves. For this study double Inconel tags were used until 1995/96 and thereafter double titanium turtle tags were used. Extra tags were replaced on turtles when existing tags were damaged, difficult to read or looked as though they might be coming off the flippers. Tags were supplied by the Division of Environment, Seychelles Government, as part of their turtle monitoring program. Prior to 1995/96 single or double Monel tags were generally used in the Seychelles (Mortimer 1999). Emergences onto land were called successful when they resulted in eggs being laid. Unsuccessful emergences were of two kinds - one where at least one failed nesting attempt was made (the turtle attempting to dig a nest hole), and the other when no attempt at digging a nest hole was made, although "test" scrapes might be made with the fore flippers.

Sequence of nesting events - The sequence of nesting events followed was based on that outlined in Witzell (1983), but see also Hendrickson (1981), and modified as shown in Table 1. Distances covered by the turtles on land were paced, each pace being recorded as a meter, and a sketch was made of each emergence. The times taken for the turtles activities were obtained using a wrist watch. The measurements and times were not precise, and interpretation of some of the activities might have been done slightly differently by different observers. One of us (PMH) did most of the observations and recordings. We believe that errors in separating activities (e.g. between the end of egg-laying and the beginning of nest filling) were not more than 30 seconds, and in most cases would be less than 15 seconds. In cases where turtles rested between activities, the rest period was considered part of the immediately preceding activity. In some cases only parts of the sequence could be obtained - these results were pooled for the individual activities. Records for two turtles which had been obviously influenced by artificial light on their return trips to the sea have been omitted from the calculations dealing with times and distances spent on land (Tables 4 to 7).

RESULTS

The mean time taken for the complete nesting sequence was 103.6 minutes (range 61-164 min) (Table 2). There is great variation in the times spent out of the sea to nest by individuals (Table 3).

Table 1: Sequence of hawksbill turtle nesting events.

Activity	Beginnings of sequences
1. Out of sea to start of body pit	Leaving the sea
2. Dig body-pit	Start sweeping sand with fore-flippers to dig body pit
3. Dig nest-hole	Start digging the nest hole with hind flippers
4. Lay eggs	Laying of first egg
5. Cover eggs	Start moving sand into the nest hole with hind flippers.
6. Camouflage nest site	Start sweeping sand randomly with fore flippers and hind flippers after tamping down the sand in the nest hole.
7. Leaving site to enter sea	Moving towards the sea without sweeping sand.

Distances covered during nesting procedures

The mean total distance covered on land by turtles for successful nesting was 91.8m. Turtles which did not attempt nests covered less total distance (mean 67.1m) than did successfully nesting turtles (91.8m), or turtles that unsuccessfully attempted to nest (mean 109.1m) (Table 4). There was no significant difference between the mean total distance covered by turtles nesting successfully, and turtles which made unsuccessful nesting attempts. There was a significant difference between the distances traveled by turtles which made no nesting attempt, and the distance traveled by turtles nesting at their first attempt (Chi-square 34.6, p=0.001). The distance that turtles traveled to the nest was found to be usually equal or longer (78.2% of all cases) to the distance they traveled from the nest back to sea (Table 5).

Those turtles which traveled a longer distance to the nest than from it back to the sea, covered significantly longer mean distances to the nest than other nesting turtles, while turtles which traveled a shorter distance to the nest than from it, covered significantly longer mean distances from the nest to the sea than other nesting turtles. The remaining mean distances covered were not significantly different (Table 6).

In an extreme case, the distances covered by a long-traveling (but not light-disoriented), turtle (#36) were 202 m to her nest site, and 70 m to return to the sea.

Rate of activities

For turtles nesting successfully, the approach to a nesting site until the start of digging a body pit was done at a much slower speed (mean 2.1 m/min, range 0.5-8.0 m/min, n=66) than when the turtle was returning to the sea after completing nesting (mean 6.3 m/min. range 2.0-21.0 m/min, n = 66). The mean speed of completing nesting from time

Table 2: Times (minutes) taken for nesting by turtles. [a] = where full nesting sequence was recorded, (n =32). [b] = for all records

Activity	Mean time[a]	% of total time	Time range[a]	Time range[b]
1. Out of sea to start of body pit	21.2	20.4%	4-86	4-86 (n=35)
2. Dig body-pit	3.7	3.6%	1-18	1-18 (n=76)
3. Dig nest-hole	23.0	22.2%	9-53	6-53 (n=92)
4. Lay eggs	19.8	19.1%	5-45	5-45 (n=120)
5. Cover eggs	12.4	12.0%	6-22	2-42 (n=127)
6. Camouflage nest site	17.8	17.2%	6-34	3-38 (n=139)
7. Leaving site to enter sea	5.7	5.5%	2-18	1-29 (n=162)
Total time out of the sea	103.6		61-164	

Table 3: Variation in individual turtle times (minutes) taken for nesting.

	Turtle No. 7	35	99	Range (min)
1. Out of sea to start of body pit	14-30(2)	14-30(2)	7-20(2)	7-30
2. Dig body-pit	1-5(3)	2-3(2)	1-4(2)	1-5
3. Dig nest-hole	28-37(3)	16-53(2)	15-29(2)	15-53
4. Lay eggs	16-19(4)	14-21(2)	12-45(4)	12-45
5. Cover eggs	8-11(3)	15-17(2)	9-18(4)	8-18
6. Camouflage nest site	14-22(3)	21-22(2)	7-19(5)	7-22
7. Leaving site to enter sea	7-10(4)	7-11(2)	3-8(5)	3-11
Range (min) of total time out of sea	102-111(2)	86-145(2)	82-129(2)	82-145

of exit from the sea to the time of re-entry into the sea was 0.87 m per min, while non-nesting turtles covered the ground at mean speeds of 2.33 m per min (Table 7).

DISCUSSION

The only nesting stages previously recorded for hawksbills from the Seychelles was by Diamond (1976) for Cousin Island, but with very few samples (maximum 6) and with four nesting sequences, excluding the return to the sea (sequence 7). A comparison with the sequences obtained from Cousine shows one major difference (Table 8).

Although sequence times 2 - 6 are not significantly different (Chi square=0.96, df 2, p=1), the discrepancy in sequence 1 times between Cousin and Cousine cannot be explained except perhaps as being a result of the low number of samples from Cousine. However, if that were the case, then it would be expected that one or more of the other sequence times would show large differences as well. Chan & Liew (1999) recorded the same nesting sequences as we did for a population of Malaysian hawksbill turtles, obtaining a longer mean nesting process duration. However, we have taken the total duration as 114 min, not 117 min as given, because the average times given by the authors add up to 114, not 117. A comparison of the times recorded there and during this study is shown in Table 9.

The percentages are not significantly different for sequences 3 to 7 (Chi-square=3.9, df 4, p=1), but are significant for sequences 1 and 2 (Chi-sq.=8.7, p=0.01)

Table 4 Distances (m) traveled by turtles with different successes at nesting

	Nested successfully			No nests		
	At 1st attempt A	At 2nd attempt B	At 3rd or 4th attempt C	No nesting attempt D	1-2 nesting attempts E	3 or more attempts F
n	173(46.6%)	37(10.0%)	11(3.0%)	111(29.9%)	32(8.6%)	7(1.9%)
SD	39.9	33.5	45.0	43.2	39.8	32.1
Range	14-274	47-177	43-189	4-193	50-209	62-165
Mean distance	88.8	102.9	101.1	67.1	107.3	117.3
Mean A+B+C	91.8			Mean E+F	109.1	

Table 5 Distance relationships between nesting sequence 1 (S1) and sequence 7 (S7)

Distance relationships:	S 1 longer than S7 by more than 5 m	S 1 and S7 within 5m	S1 shorter than S7 by more than 5 m
n (%)	73 (33.0%)	100 (45.2%)	48 (21.7%)
Total A+B	173(78.2%)		

Table 6 Distances traveled to and from nests. [a] significantly longer (Chi-sq., p=.001) than other "To nest" distances. [b] significantly longer (Chi-sq., p=.001) than other "From nest" distances

Distance relationships:	S 1 longer than S7 by more than 5 m		S 1 and S7 within 5m		S1 shorter than S7 by more than 5 m	
n	73		100		48	
Mean distance (m)	58.1[a]	37.0	40.1	41.0	39.6	53.4[b]
Range	16-202	1-87	5-89	5-89	11-75	25-113
SD	28.3	17.0	18.7	18.7	16.5	20.2

The Malaysia hawksbills were quicker to get to, or find, a nest site; but took longer to prepare the body pit prior to digging the nest hole and to camouflaging the nest site. These differences may result from the levels of natural predation under which the sea turtles evolved. In the Seychelles there were no mammalian or reptilian predators before modern man arrived on the islands, and probably this was the case since the islands existed - therefore the turtles could be less wary and faster in leaving the sea and locating a nest site. A major predator of the Malayasian nests is a species of monitor lizard which affects up to 40% of the nests (Chan & Liew 1999). The presence of such predators could also account for the longer times taken to dig a (presumably) deeper body pit and to camouflage the nest more thoroughly. Whether or not these behavioral differences are consistent and perhaps fixed genetically, is of interest.

Carr (1981) remarked on the similar, stereotyped, conservative nesting behaviour of all the species of sea-turtles - with but minor differences between genera, and between populations of the same species. While generally displaying all the described (Witzell 1983) intrinsic nesting sequences, Cousine's hawksbills show individual differences in a). times taken for nesting, b). distances traveled to complete nesting, and c). in including or excluding such behavior as testing potential nesting sites by scraping with the fore flippers. Nest holes were dug and then left only if they collapsed during the digging process - so they were not exploratory digs, but either successful or unsuccessful nesting attempts. The individual's choice of a nesting site must surely include a function of "skill" derived from "exercising" the genetically fixed nesting behavior pattern. The more times she nests, the better the behaviour pattern guides her, and the more "skilful" she gets.

One of the factors influencing choice of nest site, and therefore in the time and distance taken for nesting, lies is the terrain into which the turtle emerges from the sea. We recorded numerous instances where a poor nest site (for example a site very likely

Table 7 Distances, time out of water and speed of activities for **(A)** successfully nesting and **(B)** unsuccessfully nesting turtles for which full sequences recorded.

	A (n = 40)			B (n = 45)		
	Time (min)	**Distance (m)**	**m per min**	**Time (min)**	**Distance (m)**	**m per min**
Mean	100.90	87.97	0.87	22.70	52.89	2.33
SD	27.44	33.50		15.46	34.01	
Range	61 – 164	26 – 174		2 – 81	4 – 137	

Table 8 Comparison of nesting sequences on Cousin (A) and Cousine (B) Islands.

Sequence[a]	1	2 + 3	4	5 + 6	Total mean time (min)
A Mean time (min)	62	32	20	25	147
B Mean time (min)	21.2	26.7	19.8	30.2	97.9

[a] See table 1.

Table 9 Comparison between nesting process times in Malaysia and Seychelles.

Sequence[a]	1	2	3	4	5	6	7	Total mean time (min)
Seychelles	20.4%	3.6%	22.2%	19.1%	12.0%	17.2%	5.5%	103.6
Malaysia	12.3%	14.9%	20.2%	12.3%	8.8%	26.3%	5.3%	114.0

[a]See table 1.

to be eroded, or inundated, by the sea) was chosen. This happened, for example, when the beach eroded to a narrow strip at the base of a steep dune which was insurmountable, and where high tides swept to the base, or near the base, of the dune. Even though each individual had a choice of aborting that nesting attempt, some still chose to nest there. In other cases a female nested on or at the high-tide level - even though there was a wide beach and a variety of nesting sites within her easy reach (Hitchins *et al.* 2003b).

The reasons for this may relate to the skill of the individual - she may either be a first nester, or she may be nesting for the first time in the area - a stranger to the local conditions. Under such circumstance she might have been one of the 30% of turtles (table 4) which emerged but did not try to dig a nest. Or being a neophyte she may have lacked skill in choosing good nesting sites, in which case she could have been one of the 10% of turtles which tried, but failed, to complete a nest. We would consider a “skilful” turtle not only to be one of the 46.6% of turtles which nested at her first nesting attempt, but also one which chose a good nest site. We have not used the word “experienced” to describe such individuals, because a turtle cannot learn how to choose a good nest site from experience – she has no way of knowing what happens to her nest, of knowing if she made a good or a bad choice. The most important matter for the turtle is to locate a suitable nest site. This is defined as a site with a). a medium in which an adequate nest can be dug, and in which the eggs can incubate and hatch, and from which the hatchlings can emerge easily; and b). from which the sea is easily reached by the hatchlings.

The wariness of all sea-turtles on leaving the sea to nest, and the speed with which they return to the sea after completing nesting, indicate evolutionary traits developed to reduce predation and dehydration, and to conserve as much energy as possible. The importance of successful completion of nesting is underlined by the cessation of some survival mechanisms during part of the nesting process. During the egg-laying and nest-hole filling phase, reaction to any disturbance is “switched off”, a state which Johannes (1992) refers to as “reproductive stupor”, so that the egg-laying process has a chance of completion even in the face of potential fatal disturbance. The nesting procedure is therefore carried out under the influence of both internal and external factors, and individuals are able to “balance” some of these influences to nest skillfully in the shortest possible time. It is probable that differences in nesting sequence times between Seychelles and Malaysian hawksbills, for example, illustrate this point.

Is there any evidence that sea turtles emerging as possible neophyte nesters, or strangers to the area, pick better nesting sites more quickly with repeated use of the area? One problem we have in the case of Cousine is that inter-island nesting does take place in the Seychelles (Hitchins *et al.* 2003b) and so it is not possible to positively identify a turtle as a neophyte nester, or, because of the relatively short duration of the turtle work done on the island, whether she was a stranger to the island. The situation would be much clearer if all information on tagging results was available to us from neighboring islands; however, this was sadly not the case.

For nesting turtles sequence 1 is generally either longer than sequence 7 (Tables 1 and 5), as the turtle is searching for a nest site during sequence 1, and not simply making her way back to the sea as during sequence 7; or the two distances are about equal, since it is in the interests of energy-saving that nesting emergences and returns are ideally made straight

up and straight down the beach to and from a nest. For those turtles which attempted to nest, or did nest, the total mean distances traveled during were not significantly different. Those turtles which made no attempt to nest spent less time, and traveled shorter distances, than turtles which had nested or tried to nest. Some of the turtles which, on Cousine, returned to the sea without trying to nest had clearly been disturbed by the presence of people, but there were other cases where there was no such apparent disturbance. There are probably other factors which are disturbing to turtles, but which as yet have not been recognized as such. It is therefore not possible, at present, to say whether those turtles not attempting to nest had been disturbed in one way or another, or were engaging in some other activity (e.g. exploratory).

If the Seychelles turtles were not generally day nesters (Diamond 1976; Hitchins *et al* 2003b) disorientation resulting from artificial lights could have a far greater effect on the time spent, and distance traveled. In the two cases known where artificial lights interfered with orientation of adult turtles, sequence 7 distance was far greater (mean 223.5m, range 174-273m) than the sequence 1 distance (mean 96.5m, range 96-97m).

One female (#75) beached in the late afternoon, had three nesting attempts before finally digging her nest behind the dune crest. By the time she had finished camouflaging her nest it was dark, and on leaving the nest she paralleled the dune crest, seemingly attracted by lights on the island. She could not see the sea from behind the dune. When she reached a point 163m from the start of her nest, and beyond the influence of the island's lights, she could see the lights of a neighboring island, Praslin, and turned at right angles towards them. This led her to within sight of the sea, and she then moved directly across the beach to the surf. Before she finally reached the sea she had traveled another 116m; 369m in total. The time it took her was not recorded, but is estimated at being about 6 hours. In the only other nesting on record for #75 she also emerged in the late afternoon, and left her completed nest in the dark - however she was on the beach and with no interference from artificial lights made her way back to the sea without incident. A second female (#31) spent at least 5 hours out of the water in a sequence of events very similar to that followed by turtle #75. In this case the turtle was eventually physically turned towards the sea; she had traveled a total of 271m before entering the sea. Of the 10 nests recorded for this turtle over two seasons, all were completed in the late afternoon or early night, but only two were made behind the dune crest - the one recorded above, and the second one completed in daylight, so there was no artificial light to disorientate her.

Acknowledgements

We thank Mr. Fred Keeley and his family for their continued support and encouragement in not only the turtle monitoring programme but in all the other aspects related to maintaining the conservation status of Cousine Island.

To the following volunteers who assisted for short periods during the turtle nesting seasons, Ros Finlay, Rob Hitchins, the late Howard Otto (1996/1997), Gavin Scott and Kathy Dalley (1997/1998), our grateful thanks. Thanks to Ron Cochran for assisting with statistical calculations during finalization of the paper. Last, but not least, to Juliana Souffe for her support and interest in reporting turtle activities along the south beach, this was of immense help, thank you.

Finally, to John Nevill our thanks for his assistance during the 1995/6 season; to Dr Jeanne Mortimer, many thanks for all the assistance and support over the years.

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Relocation of 'extinct' *Ficus densifolia* Miq. (Moraceae) in Mauritius

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Five native species of fig (*Ficus* spp.) are recorded from Mauritius (Berg & Heusden, 1985). Two are relatively common and widespread occurring on all three Mascarene Islands: affouche rouge (*F. rubra* Vahl.) (also on Seychelles and Aldabra) and affouche batard (*F. reflexa* Thunb.) (also on Seychelles and Madagascar). The remaining species, *F. mauritiana* Lam., (figuier sauvage), *F. laterifolia* Vahl., (figuier blanc) and *F. densifolia* Miq., (grand affouche) are endemic to Mauritius and Reunion. The latter two species have no common names on Mauritius, apparently indicating they might have been relatively rare on the island for a long time.

F. densifolia was described in 1867 from a sample collected on Reunion where recent estimates indicate that the species is quite common (C. Lavergne pers. comm. 2006) contrary to previous information (Berg & Heusden 1985). It was not until about 85% of Mauritian forests had already been destroyed (Vaughan & Wiehe 1937), that the species was first located on Mauritius by Dr R. E. Vaughan in 1938 (Mauritius Herbarium voucher MAU 1742, Figure 1). The plant was growing in an area of marshy native vegetation in the uplands at Le Pétrin. It was an isolated tree reaching 3 m high. It was nevertheless cut down in 1968 to make way for pine plantations in the region despite being the only known individual of its species on Mauritius (G. D' Argent, pers. comm. 2006). Thirty years later a second much larger individual was found during surveys prior to the widening of the motorway at Wooton (near Curepipe, Figure 1). No effort was made to avoid the tree, instead 300 cuttings were taken, all of which failed (V. Tezoo, pers. comm. 2006), and the last known Mauritian individual of *F. densifolia* was for the second time chopped down, reflecting the importance attached to conservation in this country then ranking among the top two in the world in terms of threatened flora (Walter & Gillet 1998). From then on the species was presumed extinct on Mauritius.

On 29th January 2006, the third plant of the species ever to be located on Mauritius was discovered by the authors (MAU 24317, Fig. 1) in a patch of native upland forest heavily invaded by the alien *Psidium cattleianum* Sabine (Myrtaceae). Native constituents included mainly *Nuxia verticillata* Lam. (Stilbaceae), with some *Aphloia theiformis* (Vahl.) Benn. (Aphloiaceae) and *Calophyllum tacamahaca* Willd. (Clusiaceae). It is a thick stemmed tree branching into two main stems of 37 cm and 48 cm dbh and rising to about 9 m, with a wide crown of dense foliage. With this finding, the known habitat of the species in Mauritius falls within a zone located between altitudes of 550-680 m and receiving an annual rainfall of 2,600-3,500 mm.

Although found within the Black River Gorges National Park, the tree is not for as much safe since it grows a few metres from the Chamarel-Plaine Champagne road, which is currently being enlarged at places. The threat of seeing the last known Mauritian individual of the species being chopped down for the third time is thus real. Since only one plant growing in a heavily invaded forest is known, the species should be regarded as Critically Endangered on Mauritius (CR B1ab(iii, iv, v) + 2ab(iii, iv, v); C2a(i), D) using the IUCN criteria (IUCN 2001). The species' world status is less worrying due to its presence on Reunion.

A species recovery programme should be implemented urgently. The enlargement of the road in the vicinity of the tree should first be avoided. At the time of discovery, the tree was bearing immature fruits and their collection once mature is vital, especially because this can be a rare opportunity. The specimen in Pétrin apparently fruited only once during its 30 years of known existence (G. D'Argent, pers. comm., 2006). It is also advisable to try propagation by cuttings and if these fail then more demanding techniques as air-layering and tissue culture should be attempted. Further surveys in the region should also be conducted to try find more individuals. The National Parks and Conservation Services, the Government institution responsible for the management of the National Park has started weeding out alien species around the tree.

Ficus is an essential component of tropical forests, being claimed to be "*the most important plant genus for tropical frugivores*" (Shanahan *et al.* 2001). Some

Fig. 1 Distribution of *F. densifolia* in Mauritius, with year of discovery of each tree. Only the tree found in 2006 survives.

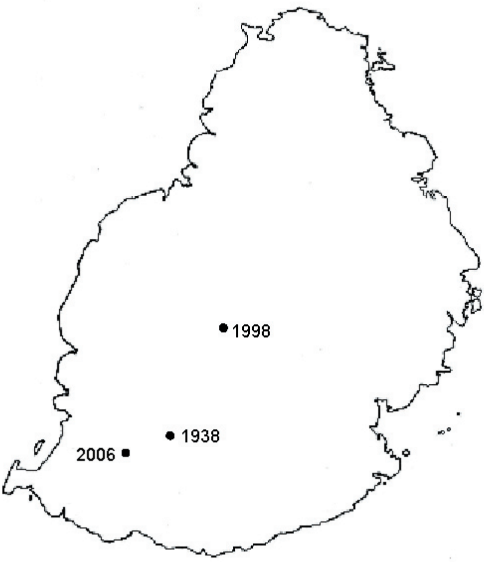

Fig. 2. The surviving Mauritian *Ficus densifolia*

authors consider the genus as containing many keystone species (Nason *et al.* 1998, Kannan & James 1999), and *in-situ* species recovery programmes suggest conservation or planting of fig species to sustain or increase fig-eating bird communities (Evans 1979; Lambert 1991). *F. densifolia*'s presence on Reunion should be no excuse to allow the species and its ecological role to disappear from Mauritius.

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Partial albinism in the hawksbill turtle (*Eretmochelys imbricata*) on Cousine Island, Seychelles.

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During work on hawksbill turtles on Cousine Island in the Seychelles, 74020 hatchlings (1995-2004) were examined (Table 1). Two of these, from one nest, displayed partial albinism of the fore-fippers (Fig 1). These hatchlings displayed no other apparent morphological or deformities, and were released with their normally coloured siblings.

Albinism is apparently rare among sea-turtle, being reported from loggerhead turtles (*Caretta caretta* L.) for which Prichard (1979) reported that "in some areas it is not uncommon to find one or two non-viable albinos in a nest: this albinism is often correlated with mouth deformities and cyclopism." Hughes *et. al* (1967) reported that

albino hatchlings had been observed only rarely in Tongaland, South Africa. At least one such hatchling from Tongaland was a full albino, and was fully developed in the egg, but had not hatched. It had no apparent deformities (O. Bourquin, pers. com. 2001).

Aldabra hawksbill turtles often have "blonde" carapacial scutes, in which each scute has extensive unpigmented areas, and one such animal has also been found in northern Mocambique (Pritchard 1979). However, whether this constitutes albinism is not known. No other record of albinism or partial albinism was found in literature for hawksbill turtles, or other sea-turtles.

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Table 1. Numbers of hatchlings examined: 1995/1996 to 2003/2004 seasons

Season	No hatchlings examined	No with albinism	% of total
1995 – 1996	2749	0	
1996 – 1997	5119	0	
1997 – 1998	7841	0	
1998 – 1999	13002	0	
1999 – 2000	1869	2	0.1
2000 – 2001	10197	0	
Sub total	**40777**	**2**	**0.005**
2001 – 2002	8313	0	
2002 – 2003	11153	0	
2003-2004	13777	0	
Sub total	**33243**	0	
TOTAL	**74020**	**2**	**0.003**

Fig. 1. Partial albino hatchlings on Cousine island.